| | |
|---|---|
| **From:** | Mark Hutson |
| **To:** | Ohl, Matthew |
| **Cc:** | Exemption 6 Charles Norris |
| **Subject:** | PINES Comments on 2nd draft Feasibility Study |
| **Date:** | Tuesday, July 02, 2013 2:03:36 PM |
| **Attachments:** | 20130702 PINES Comments on 2nd draft FS_FNL.pdf |

---

Matt
On behalf of People in Need of Environmental Security (PINES), I am attaching comments of the 2nd draft Feasibility Study on the Pines site.
Please let me know if you have questions or need additional information.

Mark


**Mark Hutson**
**Geo-Hydro, Inc**
303-948-1417
mhutson@geo-hydro.com

GEO-HYDRO, INC
Consulting in Geology and Hydrogeology

1928 E. 14th Avenue
Denver, Colorado 80206
(303) 322-3171

# Comments on the Feasibility Study

Prepared by Geo-Hydro Inc. on behalf of
People in Need of Environmental Safety
July 2, 2013

Geo-Hydro Inc. (GHI) is submitting the following comments on the Feasibility Study (FS) for the Pines Area of Investigation dated June 2013, on behalf of People In Need of Environmental Safety (PINES). Our general and specific comments on that document are provided below. Additional comments on the radiological characterization of CCBs in the study area provided by Mr. Larry Jensen, a health physicist and member of PINES, are attached. The combined comments identify significant technical issues associated with the FS.

## General Comments

*Infiltration Control*

As we have discussed in comments on several previous documents, adequate long-term reduction and minimization of leachate formation at the source will be critical to successful protection of human health and the environment. Unlike organic-rich wastes that are commonly disposed in landfills, coal combustion byproducts (CCBs) are primarily composed of inorganic materials that do not biodegrade in a landfill cell. Water that infiltrates vertically or laterally into the waste reacts with the waste and mobilizes contaminants, and creating CCB-contaminated leachate as long as mobile constituents remain in the waste. The remedy selected for Yard 520 must be capable of controlling formation and migration of CCB leachate over a time period substantially longer than the 30 years of operation and maintenance assumed in the FS. Alternatives that include removal or physical containment of the source materials should be preferred over active systems that will require significant operation and maintenance over an extended (essentially perpetual) period of time.

GHI again notes that none of the remedial alternatives discussed in the FS include measures to control infiltration of precipitation through the existing soil landfill cover and CCB. Infiltration of precipitation through the soil cap and into the disposed waste results in leachate formation and will continue to do so far into the future. Mounding of leachate within the landfill provides the head that drives migration of leachate away from Yard 520 in all directions. Controlling infiltration of precipitation into and through the CCB must be the critical part of any long-term remedy for Yard 520 that allows the CCBs to remain there.

The inadequacy of the existing soil cap was previously documented during the RI at former piezometer PZ001 where a leachate mound and still-rising heads (climbing from 619.56 to 622.95 feet above mean sea level (MSL)) were observed near the center of the landfill mass during the time that field measurements were being conducted. Unfortunately, the United States Environmental Protection Agency (USEPA) acquiesced to Respondents' requests to immediately remove PZ001 upon completion of the planned RI sampling period. Removal of the only monitoring point within the landfill has effectively eliminated the ability of USEPA or Indiana Department of Environmental Management (IDEM) to monitor leachate head within the landfill. However, documents recently made publicly available in the IDEM Virtual File Cabinet independently confirm that the existing soil cover currently in place on Yard 520 does not prevent infiltration of precipitation into the waste.

Inspections of Yard 520 conducted during the summers of 2010 and 2011, inspections repetitively requested by PINES, documented persistent leachate seeps from the west side slope of the landfill adjacent to Birch Street. IDEM subsequently required the facility to plan and conduct a site assessment to investigate the area of concern and recommend follow-up remedial actions, if appropriate. Activities conducted as part of the site assessment included:

1. Installation of three new piezometers along the southwest landfill boundary, near the base of the landfill side-slope.
2. Advancement of four soil probes located upslope of the piezometers to assess cap thickness.
3. Collection of one year of monthly groundwater elevation measurements.
4. Precipitation data for the National Oceanic and Atmospheric Administration's (NOAA) rain station at Chesterton, IN was accessed for comparison to groundwater elevations.

Results were reported to IDEM in a Site Assessment Report dated August 21, 2012 (Appendix A). The report shows that while final cover thickness requirements exceed the required minimum thickness and the vegetative cover is in good condition, the landfilled waste is not being isolated from infiltrating precipitation. The report states (p.9),

> *In general, the patterns in groundwater elevations were closely tied to changes in precipitation. Increases or decreases in precipitation resulted in corresponding changes in the groundwater elevation almost simultaneously.*

Two of the three newly installed piezometers (PZ-1 and PZ-3) showed this general pattern of nearly simultaneous increases or decreases in leachate head with precipitation. The third piezometer (PZ-2) showed unexpectedly high heads[1] ranging from 619.32 to 621.06 (consistent with heads measured in PZ001 during the RI and above ground elevation at the PZ-2 location.). The hydrograph at PZ-2

[1] The cause of the high heads recorded at PZ-2 remained officially unresolved as of the time of an April 2, 2013 letter from IDEM (Appendix B) to the facility that requested the facility to provide additional data or propose an additional investigation plan to determine the source of the elevated leachate elevations.

also correlated with the precipitation curve when the hydrograph was adjusted for a lag-time that was observed between the precipitation patterns and the corresponding change in potentiometric surface at PZ-2.

The full understanding of the elevated leachate elevations and associated leachate seeps near PZ-2 will await determination of the current elevation and orientation of the leachate mound and more detailed characterization geometry of the hydraulic connection between the CCBs in the landfill and the immediately underlying surficial sand unit. Regardless of the details causing the high leachate elevations in PZ-2, the strongly correlated and nearly simultaneous response of leachate head to precipitation events documented in this report is a clear indication that the current landfill cover, while apparently meeting minimum thickness standards, is ineffective at preventing substantial and damaging rates of infiltration of precipitation through the cap and into the disposed waste. An actual landfill cap, rather than the minimally required final soil cover, is necessary to control infiltration, minimize future leachate generation, and decrease the head that drives leachate away from the landfill into the surrounding areas.

*Groundwater Quality Trends*

Groundwater monitoring reports from October 2011 and April 2012 are appended to the FS to support claims of decreasing concentrations of CCB-derived constituents in groundwater. GHI downloaded the most recent groundwater monitoring report (October 2012, Appendix C) from IDEM's virtual file cabinet in order to review the most recent site water quality data. The October 2012 monitoring report identifies the following statistically significant upward concentration trends in the following wells:

- Barium (dissolved) at MW-13S;
- Boron (dissolved) at MW-13S, MW-14S, and MW-14D;
- Manganese (dissolved) at MW-13S, and MW-14D;
- Potassium (dissolved) MW-13S; and
- Sulfate at MW-14D.

These wells[2] are all located north of US Highway 20 near residential areas of Town of Pines. Contrary to what is described in the FS, groundwater quality has neither stabilized nor improved in the area north of Yard 520 characterized by these monitoring points.

[2] The referenced monitoring reports continue the inaccurate representation of each of these wells as being located upgradient of Yard 520. Each of these wells is, in fact, located downgradient of the landfill and analyses from these wells represent downgradient water quality. This errant representation was reinstituted in monitoring reports after removal of PZ001 from Yard 520 following completion of RI sampling activities, thus allowing the known presence of mounded leachate within the landfill to be ignored. The monitoring program at Yard 520 needs significant revision to accurately identify and reflect conditions at the site, but to date IDEM has not so required.

**Specific Comments**

1. Page 2-1, Section 2.1.1, 2nd paragraph – Contrary to what is stated in this paragraph, groundwater gradient reversal north of the Yard 520 landfill is not short-term, is not local, and does affect overall groundwater flow. Significant mounded leachate within Yard 520 was identified during the remedial investigation (RI) and has again been identified during investigation of seeps located near the southwest corner of the landfill (see general comment on Infiltration Control). The height of the mounding was still rising at the time RI monitoring within the landfill ceased. The leachate mound reversed the groundwater flow gradient north of the landfill and causes CCW leachate to flow from Yard 520 toward the north, through the neighborhood and toward the Great Marsh of IDNS. It is a complete and lasting reversal of any anticipated 'normal' flow direction. The northward groundwater gradient on the north side of Yard 520 will remain as long as precipitation is allowed to continue to infiltrate through the "clayey soil cover" presently atop the landfill surface. The mounded leachate condition will continue unless remedial actions are taken to remedy this situation.[3]

2. Page 2-2, Section 2.1.3 – This section states that the CCBs present in Yard 520 and the suspected CCBs within the Pines Area of Investigation are not the same materials. This assertion is unfounded. The extent and type(s) of CCBs in residential yards has not yet been adequately characterized. Investigation of the presence or absence of CCBs in residential yards has so far been made on the basis of samples collected from the upper 6-inches of soil. The types and extent of CCBs present below 6-inches remain uninvestigated. It is reasonable to believe that CCBs used as road base may have been predominantly coarse-grained, but the characteristics of CCBs in residential yards has yet to be determined.

3. Page 2-3, Section 2.2.1 – The visual inspection program was based on samples collected from the upper 6-inches of soil, an interval that necessarily would have been mixed or covered with topsoil in order to support vegetative growth. Results of this investigation are not necessarily representative of the CCB content or composition of materials located deeper in the soil profile. The statistical evaluation of CCB concentrations and exposure point concentrations presented in this section are based on a skewed sample population that may underestimate existence of and potential exposure to CCBs in the soil.

4. Page 2-8, Section 2.2.4, 1st paragraph – The last sentence of this paragraph speculates that paving of roadways may reduce groundwater recharge and migration of CCB-related constituents to groundwater. This speculation is likely correct, but only for CCBs located directly beneath an impermeable pavement. It is noted the same benefit from placing an

[3] The northward migration of leachate from Yard 520 is only one of the impacts of allowing the in-waste mounding to persist. Unpermitted discharges from the flanks of Yard 520 persist to the east, south, and west, as well.

impermeable cap over the large deposits of CCBs in Yard 520 and other areas could be speculated. An appropriately performing cap (as opposed to the existing soil cover) over the large deposits of CCBs like Yard 520 must be included in any remedy that does not include waste removal in order to minimize leachate formation and reduce the existing head within Yard 520. The U.S. Corps of Engineers Hydrologic Evaluation of Landfill Performance (HELP) model is routinely employed to investigate landfill cap performance. HELP modeling should be performed to quantify the expected performance of the existing clayey soil cover relative to an upgraded landfill cap. The benefit of preventing vertical infiltration through CCBs through the installation of deliberate or incidental impermeable caps does not impact the lateral migration of groundwater through CCBs below the caps.

5. Page 2.8, Section 2.2.4, 2nd paragraph - The statement that, *…all groundwater containing CCB-derived constituents flows towards and into the Brown Ditch system, including its related tributaries and wetlands* is both in error and conveniently obfuscates the facts. The reversed groundwater gradients north of Yard 520 transport CCB-derived constituents on a pathway now below residential areas of Town of Pines (see general comment on Infiltration Control) prior to eventual discharge into wetlands areas of Indiana Dunes National Lakeshore (IDNL), not all of which are part of Brown Ditch drainage. Making this erroneous statement yet again does not make it correct.

6. Page 2-8, Section 2.2.4, 3rd paragraph - This paragraph states, *based on the available information, CCB-derived constituents in groundwater do not extend northward into IDNL at levels of significance*. The paragraph also states, *CCB-derived constituents do not currently appear to extend to areas where private water wells are located outside the area currently supplied by municipal drinking water*. The location of the leading edge of CCB-derived contaminants in groundwater has not been determined (see comment #7). Therefore, there is no demonstration that the contaminant plume is not still expanding; such demonstration requires the leading edge be identified. The statements do not acknowledge the longer-term and expanding hazard evidenced by the increasing concentrations of CCB-derived constituents documented in semi-annual sampling of Yard 520 monitoring wells since completion of the RI. The increasing concentrations of CCB-derived constituents reported to IDEM were brought to the attention of USEPA by GHI in comments on the Development and Screening of Alternatives memorandum. Fully considered, "based on the available information," the conditions that existed at the end of the RI are demonstrably neither worst case nor the maximum extent of contamination. The CCB-derived contaminants migrate, and will continue to migrate, with northward flowing groundwater thru residential areas and toward IDNL. They will do so at increasing concentrations. This dynamic condition will persist until Yard 520 CCBs are exhumed, the groundwater head within the landfill is reduced, or a permanent containment remedy is put in place. Given the current lack of

adequate definition of source concentrations, hydraulic gradients and contaminant migration pathways from Yard 520 across the community, PINES requests that EPA cause the municipal water supply system be extended to residences that remain dependant on bottled water and those that could be impacted in the future.

7. Page 2-9, Section 2.2.4, 1st paragraph – This section of the FS presents boron concentrations from carefully selected monitoring wells located in areas well north of Yard 520 and suggests that relatively stable concentrations in these wells are an indication that CCB-related constituents do not extend to IDNL and are not migrating toward IDNL. The concentration of CCB-derived contaminants in a few wells near the source says nothing about the location of the leading edge of the plume. Monitoring wells placed within active contaminant plumes often show steady contaminant concentrations, or within a narrow range, even as the leading edge continues to migrate downgradient. Observing consistent concentrations within an established, active plume does not provide evidence of immobile contaminants; they monitor passage of a plume with a consistent composition. Monitoring points located in front of the leading edge of a contaminant plume are necessary to determine how far a plume has advanced and whether it is still advancing. Yet unaddressed are increasing concentrations of CCB-derived contaminants that are observed in Yard 520 monitoring wells located north of US Highway 20 north of Yard 520 (see general comments).

8. Page 2-9, Section 2.2.4, 2nd paragraph – This paragraph states that there has been no significant change in groundwater levels or hydraulic gradients since completion of the RI field work. The groundwater mound within the landfill provides the driving head in the shallow groundwater system in the vicinity of Yard 520. The mound showed increasing elevation during the limited period of observations of the RI. Its effects have now been identified on the southwest corner of the north landfill (see general comments). The current height and configuration of the leachate mound in the landfill is unknown because it has never been investigated. Failure to adequately document changes in the hydraulic gradient does not mean that there has been no significant change. The increases in CCB-derived contaminants documented in Yard 520 monitoring wells located north of the landfill and anomalously high heads identified during investigation of seeps on the southwest corner of the landfill argue that the mound, and therefore the outward gradients, may be increasing.[4]

9. Page 3-7, Section 3.3.1, 4th paragraph – This paragraph asserts that Yard 520 is in compliance with applicable IDEM regulations. On its face, such an assertion is absurd. Were the landfill compliant with regulations, Yard 520 would not be part of an alternative

[4] Alternatively, or in addition, increasing contaminant concentrations may indicate weathering of the CCBs in the landfill to materials that produce worsening leachate compositions. Investigating this anticipatable change, like documenting changes of the driving heads within the landfill, is being avoided.

Superfund action and a major focus of this RIFS. For example, closure requirements for Restricted Waste Sites Type I and Type II (329 IAC 10-30-1) contains a performance standard that states that owners shall close the facilities in a manner that *controls post-closure escape of waste, waste constituents, leachate, contaminated precipitation, or waste decomposition products to the ground or surface waters or the atmosphere.* North Yard 520 has been unsuccessful in meeting this performance standard for decades. That is why Yard 520 is part of this investigation and study. IDEM's approach toward regulating this facility, however curious and often disturbing, is irrelevant to the RIFS, and it is certainly not a valid argument of no problem.[5]

10. Page 4-1, Section 4.1, 3rd paragraph – Closure of Yard 520 was a required element of the IDEM–issued landfill permit, not a response action. The cost of placing final cover over the landfill should not be included in response cost calculations.

11. Page 4-4, Section 4.2 – This section provides a litany of reasons why the shallow sand aquifer in Town of Pines cannot possibly be usable for drinking water, ignoring the fact that the aquifer actually was used for water supply until releases of CCB-derived constituents contaminated the resource. In fact, the aquifer is still being used as the drinking water source in areas of Town of Pines that are outside of the area where municipal water service has been provided. We suspect that the citizens of Town of Pines will be particularly outraged to learn that the aquifer upon which many have depended upon for generations and continue to depend were it to be reclassified as unusable because of the Respondent's quest to evade Remedial Action Objective (RAO) 3 and National Contingency Plan (NCP) expectation of groundwater restoration.

12. Page 4-5, Section 4.2, 1st full paragraph - RAO 3 sets the objective of restoring groundwater quality within a timeframe that is reasonable considering practicable response action alternatives. The suggestion that EPA consider something on the order of 205 years a reasonable timeframe for groundwater restoration strains credulity; 205 years does not qualify as a reasonable period. More importantly, 205 years might well not be long enough for CCB-derived groundwater impacts to disperse and groundwater quality to be restored so long as the source is not contained or is not removed. Unlike organic-rich wastes, coal combustion byproducts (CCBs) are primarily composed of inorganic materials that do not biodegrade. Water that infiltrates into the waste dissolves contaminants and creates CCB-contaminated leachate as long as leachable constituents remain in the waste. As CCB

[5] While the issue of the compliance status of Yard 520 within IDEM operations is not relevant to the FS report, the Respondents do acknowledge a remarkably contradictory situation, an 800-pound gorilla, if you will, that may be of interest to USEPA under other rubric. How does a facility that is central to creation of a Superfund site still remain compliant with solid waste regulations in the perception of the designated regulatory authority?

materials weather, some contaminants are temporarily sequestered until those intermediate phases themselves weather and leach. Contaminants sequestered initially in glass phase become mobile long-term as glass devitrifies. There are several practical response action alternatives that, if implemented appropriately, would restore groundwater quality over a reasonable timeframe.

13. Page 4-11, Section 4.6.1.1 – Appendix C of the FS provides the April 2012 Yard 520 Post-Closure Monitoring Report. This report provides the results of long (entire record) and short-term (last 4 years) Mann-Kendall trend analysis that was performed on Yard 520 monitoring wells. The conclusions of this report state that long-term testing results identified a total of 70 statistically significant upward trends, 22 of these were at wells identified in the report as 'upgradient' monitoring wells. A total of 66 statistically significant downward trends were identified in long-term testing. Short-term testing identified a total of 26 statistically significant upward trends, 8 of these at 'upgradient' wells. These results do not include locations with contaminant concentrations that have more than doubled in some cases but are none the less deemed 'not statistically significant' using this statistical approach.

    As was previously discussed in our general comments, the subsequent monitoring report from the October 2012 sampling event (Appendix C) again identified statistically significant upward concentration trends in several wells located north of US Highway 20. The statistical trends identified in the monitoring report serve as an independent statistical verification of increasing concentrations of CCB-derived contaminants in groundwater north of Yard 520. These contaminants will continue to migrate with northward flowing groundwater thru residential areas and toward IDNL unless the leachate head within the landfill is reduced, waste is exhumed, or a permanent groundwater containment remedy is put in place.

14. Page 4-13, Section 4.6.1.2, 3rd paragraph – The concentration of CCB-derived contaminants in a few wells says nothing about the location of the leading edge of the plume. Monitoring wells located within contaminant plumes often show contaminant concentrations within a narrow and stable range even as the leading edge continues to expand downgradient. Monitoring points located in front of the leading edge of a contaminant plume are necessary to determine how far a plume has advanced and whether downgradient plume growth is occurring. Effective mitigation of the leachate mound within Yard 520, the driving head responsible for reversing groundwater flow and driving contaminants toward the north, is needed to restore groundwater quality (RAO 3) and protect IDNL (RAO 6). See also specific comment 7, above.

15. Page 5-1, Section 5, 1st and 2nd bullets – 329 IAC 10-30-3 requires owners and operators of Type II Restricted Waste Landfills, such as North Yard 520, to apply and compact final cover of not less than two-feet as part of normal closure activities. The respondents closed

Yard 520 in conformance with 329 IAC 10-30-3 by placing a "clayey soil cover" over the waste. Costs associated with closure of Yard 520 required by normal closure regulations must not be allowed as response action costs.

16. Page 6-6, Section 6.3.1, Containment – Upgrading the existing soil landfill cover has already been shown to be necessary and should be included in the FS as a needed action rather than as an on-going process of repairing the existing ineffective cover. The presence of mounded leachate with the landfill mass identified during the RI and again more recently during investigation of seeps emanating from the southwest corner of the north landfill clearly shows that the current soil cover is inadequate to minimize infiltration into the waste. Containment alternatives must include construction of an effective engineered cap over Yard 520 that is capable of minimizing infiltration of precipitation into the waste and reduce the head of mounded leachate within the waste coupled with one of the leachate containment alternatives.

17. Page 6-7, Section 6.3.3, No Further Action – The Yard 520 closure is described as having been completed in accordance with applicable IDEM regulations. Closure requirements for Restricted Waste Sites Type I and Type II (329 IAC 10-30-1) contains a performance standard that states that owners shall close the facilities in a manner that *controls post-closure escape of waste, waste constituents, leachate, contaminated precipitation, or waste decomposition products to the ground or surface waters or the atmosphere.* Closure of Yard 520 has been unsuccessful in meeting this performance standard. The closure that was conducted has been shown to be ineffective at containing waste-related contaminants in the landfill and should therefore not be considered complete.

18. Page 7-2, Section 7.1.1.1, No Further Action – See comment #17

19. Page 7-2, Section 7.1.1.2, Cap Improvements – This section continues to describe the existing soil cover as if it was functioning properly to minimize infiltration into the waste and contain waste-related contaminants. Closure requirements for Restricted Waste Sites Type I and Type II (329 IAC 10-30-1) contains a performance standard that states that owners shall close the facilities in a manner that *controls post-closure escape of waste, waste constituents, leachate, contaminated precipitation, or waste decomposition products to the ground or surface waters or the atmosphere.* This standard has demonstrably not been met (see general comments). Visual assessment and repair of an inadequately designed, non-functional landfill cover will not enhance containment. Replacing the soil cover with an engineered cap sufficient to meet the performance standard that has, so far, not been enforced by IDEM must be included as a retained technology in Alternative 2.

20. Page 7-3, Section 7.1.2.2, Soil Alternative 2 - Implementation of land use controls on affected properties would effectively redistribute the costs of compliance from the Respondents to property owners and Town of Pines in the form of reduced property values, maintenance costs, and enforcement and/or inspection costs. Redistribution of the costs of remediation from the Respondents to local residents and municipality was not intended by CERCLA and would be poorly received by the public.

21. Page 7-4, Section 7.1.3 – Each of the retained groundwater alternatives includes a monitoring component claimed to be in accordance with IDEM requirements that is unambiguously inadequate. The groundwater monitoring program for Yard 520 must be modified to accurately reflect the direction of groundwater flow, monitor the elevation of mounded leachate within Yard 520, and provide comparisons to upgradient wells that are not themselves impacted by leachate migrating from the landfill. Additional monitoring locations are needed to document the current extent of the plume and provide evidence of the rate of expansion of the plume until it is at least stabilized. Additional monitoring points may be necessary to characterize releases from other CCB source areas (RAO 5) and to detect migration of the leading edge of the contaminant plume in the direction of IDNL (RAO 6) and toward any other receptors.

22. Page 8-4, Section 8.3.1.4 - See comments #16 and 17.

23. Page 8-5, Section 8.3.2.1 – See comment #19.

24. Page 8-8, Section 8.3.4 - See comment #20.

25. Page 8-12, Section 8.3.6, Groundwater Alternative 1A – No Further Action is simply that, nothing would be done to contain CCB-derived contaminants to Yard 520 or restore groundwater quality. Under this scenario a functioning landfill cap would never be installed, mounded leachate will continue to drive CCB-derived contaminants away from the landfill, contaminant levels will continue to increase near the landfill, and contaminated groundwater will migrate further toward residential areas and IDNL.

26. Page 8-14, Section 8.3.7, Groundwater Alternative 1B – No Further Action + Monitoring Upgradient of IDNL is essentially a do nothing approach with the addition of additional monitoring that, given the known releases and inadequate and misleading monitoring program at the IDEM administered facility, should have already been required of the operators of Yard 520.

27. Page 8-16, Section 8.3.8, Groundwater Alternative 2 – Land use controls and deed restrictions are not treatment alternatives and have no ability to reduce toxicity, mobility, or

volume of contaminants. Short-term land use controls may be a necessary action used to assure public safety and satisfy RAO 2 while actual remedial systems are in the process of restoring groundwater quality. Permanent land use controls or deed restrictions on residential properties will impose the burden property devaluation on impacted citizens, and enforcement and administration costs on the municipality for the benefit of the Respondents (see comment #20).

28. Page 8-18, Section 8.3.9, Groundwater Alternative 3 - Monitored Natural Attenuation (MNA) could be a cost effective secondary method to deal with remnant contaminants in groundwater located outside of containment structures, were such containment implemented. Given the inorganic nature of CCB's and the very long timeframes over which leaching occurs,[6] use of MNA as a primary alternative would fail to meet the reasonable timeframe requirements of RAO 3.

29. Page 8-21, Section 8.3.10, Groundwater Alternative 4 - Phytoremediation could be a cost effective secondary method to deal with remnant contaminants in groundwater located outside of containment structures or facilities, were such containment implemented. Given the inorganic nature of CCB's and the very long timeframes over which leaching will occur, use of phytoremediation as a primary alternative would fail to meet the reasonable timeframe requirements of RAO 3.

30. Page 8-24, Section 8.3.11, Groundwater Alternative 5A - The Barrier Wall–North, East, & West alternative merits close examination as a remediation alternative, however, it must be combined with an upgrade of the final landfill cover that has been placed on the landfill. An engineered landfill cap that minimizes infiltration of water into the landfill is a necessary component of any meaningful remedy. Without an upgraded cap the leachate level within the landfill will overtop the barrier wall once collection and treatment of leachate from the French drain collector is terminated. Management of water within the wall boundaries is acknowledged as an issue in subsection 8.3.11.1, but an upgrade from final landfill cover to a functional cap was not considered. The clayey soil final cover that was placed over the waste during closure is not equivalent to a fully functioning landfill cap; the build-up of leachate head within the landfill has persistently caused leachate seeps on the southwest corner of the north landfill.

31. Page 8-28, Section 8.3.12, Groundwater Alternative 5B – The Barrier Wall- East alternative is subject to all of the same comments as the full barrier wall (see comment #30) with the

[6] USEPA Project Team for PINES is encouraged to review USEPA's Risk Assessments that were performed as part of its evaluation of appropriate regulatory structures for CCB disposal areas for an appreciation of the time frames involved in contamination from un-remediated facilities.

additional caveat that this alternative would likely do little to restore groundwater quality to the north or west of Yard 520. The effectiveness of this alternative would be much less than the full barrier. The only apparent value to this alternative appears to be a lower construction cost than is estimated for Alternative 5A.

32. Page 8-32, Section 8.3.13, Groundwater Alternative 6A - Groundwater Interception-North & East could be effective at capturing contaminants from Yard 520 as long as the extraction and treatment systems are properly designed, operated and maintained. What, if any, affect these systems might have on contaminant levels to the west and northwest of Yard 520 is not known and would need to be investigated and quantified prior to selection. It is certain that the assumed 30 years of O&M would be insufficient to protect groundwater quality since CCBs are known to leach contaminants into groundwater for many decades. The only apparent value to this alternative appears to be a lower construction and O&M costs than is estimated for Alternative 6B.

33. Page 8-36, Section 8.3.14, Groundwater Alternative 6B – The Groundwater Interception-North, East and West alternative could be effective at capturing contaminants from Yard 520 as long as the extraction and treatment systems are properly designed, operated and maintained. It is certain that the assumed 30 years of O&M would be insufficient to protect groundwater quality since CCBs are known to leach contaminants into groundwater for many decades.

34. Page 8-39, Section 8.3.15, Groundwater Alternative 6C – Groundwater Interception- East is subject to the same comments as Alternative 6A (comment #32), except that the anticipated affect of this alternative on contaminant migration toward the north, west and northwest are even more tenuous. A serious groundwater modeling effort (unlike the previous effort that was eventually rejected by EPA) would be required to justify selection of this alternative. The only apparent value to this alternative appears to be a lower construction and O&M costs than is estimated for Alternative 6B.

35. Page 9-1, Section 9.2, Comparative Analysis – CCBs are primarily composed of inorganic materials that do not biodegrade in a landfill. Water that infiltrates vertically or laterally into the waste dissolves contaminants and creates CCB-contaminated leachate as long as leachable constituents remain in the waste, including those temporarily sequestered in intermediate weathering phases and glass phase that has yet to devitrify. Any remedy selected for Yard 520 must be capable of controlling formation and migration of CCB leachate over a time period substantially longer than the 30 years of operation and maintenance assumed in the FS alternatives. Passive containment systems requiring minimal active operation and maintenance should be preferred over more active options due to the

time-frame, decades to centuries, over which contaminants will be released from CCBs left in place.

36. Page 9-4, Section 9.2.2.1, 1st bullet – Inadequacy of the existing final cover is clear. Infiltration through the cover has resulted in mounded leachate that was observed to be increasing during the RI. This mounded leachate provides the head that reverses the hydraulic gradient north of Yard 520 and drives CCB-derived contaminants out of the landfill. None of retained alternatives can be successful at restoring groundwater quality for the necessary timeframe unless the final cover is upgraded to a landfill cap capable of controlling infiltration.

37. Page 9-4, Section 9.2.2.1, 3rd bullet – See comment #13.

38. Page 9-5, Section 9.2.1, 1st bullet – See comment #14.

39. Page 9-5, Section 9.2.1, 2nd bullet – See comments #20 and 27.

40. Page 9-4, Section 9.2.2.1 – This section repeatedly claims that previously completed response actions, including Yard 520 closure, have *reduced infiltration into Yard 520 and therefore groundwater migration away from Yard 520.* Several of our previous comments have pointed out the fact that the closure of Yard 520 performed to date is inadequate (See, for example, comments # 8, 9, 17, and general comments).

41. Page 9-4, Section 9.2.2.1, 3rd bullet – See comment #13 and general comments.

42. Page 9-5, Section 9.2.2.1, 2nd bullet – See comment # 27.

43. Page 9-8, Section 9.3.3 - The ranking of the alternatives is disappointing but not surprising, and is consistent with the persistent threads permeating this RI/FS effort. The highest-ranking alternatives are those that provide no meaningful restoration of groundwater quality and leave the residents of Town of Pines with a degraded environment. If the highest ranked alternatives were all that is required by USEPA, we should see no diminution of continuing release of contaminants from CCB deposits. Public acceptance of the alternatives scored highest by the Respondents should be expected to be very low.

44. Appendix G, Section 1.0, Radiological Assessment – The proposed plan does not make it clear how results of the radiological surveys of properties will be used to guide selection of subsequent soil sample collection locations. Sampling should be conducted on areas showing relatively high instrument response to radiation (natural or otherwise). If the results of the radiological surveys are not used to guide selection of sample locations the utility of the radiologic surveys will be lost.

45. Appendix G, Section 3.0, Property Soil Sampling within the Area of Investigation - The proposed quadrant approach to property sampling will effectively ignore valuable information that may be obtained from the radiologic surveys and fail to validate the radiological survey results with laboratory data. Discrete soil samples should be collected from locations in each property that show elevated responses on field radiological instrumentation. Areas of elevated response on radiologic instrumentation must be added to the list of additional sampling quandrants, along with gardens, unpaved driveways, and child's play areas.

# Attachment

# COMMENTS PROVIDED BY LARRY JENSEN (PINES)

**Review of Feasibility Study for Yard 520**
**Dated June 2013**

**By Larry Jensen**
**June 7, 2013**

**Revised Draft FS Final 2013-06-03 RLSO**

**Page 2-18** The background of 2.15 picocuries per gram (pCi/g) Total Radium (Ra-226 + Ra-228) is incorrect. Data provided in Attachment F2 to Appendix F, Tables, Table 2, shows that only 4 of 24 total radium values are not based on estimated values. These four unestimated values are 0.523, 1.104, 0.414, 0.922 pCi/g with a mean of 0.741 pCi/g. This is the value that should be used for background Total Radium (0.741 pCi/g).

It is not clear if the laboratory held the soil samples to allow for radon ingrowth before measurement. Not doing so could lead to an underestimate in the concentration.

**Page 4-11 – Surface Soil** It is incorrect to restrict exposure to surface materials only. For example, gamma emissions are detectable with standard count rate meters to about 3 feet below ground surface (bgs) so that exposure from buried contaminants can occur as well. Moreover, plant nutrients come from below the surface so that ingestion exposure may come from that depth as well. Moreover, Attachment I1 to Appendix 1 states that well drillers found 6 feet of fly ash below the Town Hall property. This material was very likely intruded into when the Town Hall was recently built.

**Page 4-11 – Near-Surface Soil** Under the 40 CFR 192 mill tailings standards, soil criteria are applied to each 6 inch depth. Using a depth range of 6 – 18 inches does not correspond to the Total Radium soil criterion. The proper depths should be 6 – 12 inches and 12 – 18 inches.

It is inappropriate to assume that digging under pavement can be restricted by deed restrictions. Street maintenance, for example, is a regular action that could be halted by deed restrictions to the detriment of the Town of Pines. This section does not answer the question of what to do with contaminated soils if maintenance must be done, nor how to protect workers. It is prudent to deal with contaminated soils from the outset and not rely on deed restrictions.

It is unreasonable to assume that construction activities below 18 inches will always require substantive earth-moving equipment. A man with a shovel could easily dig an 18 inch hole. Moreover, there are many reasons to assume that digging deeper than 18 inches would be a common action for workers and citizens. Water lines break. Trees get planted. All would reasonably go deeper than 18 inches. Therefore, again, it is prudent to deal with contaminated soils from the outset and not rely on institutional controls.

**Page 6-6, Section 6.3.2, bullet 1** This section states " No action would be taken to address constituents in soil where CCB-derived COCs are present at concentrations exceeding the PRGs." This is an inappropriate action.

**Page 7-3, Section 7.1.2.2 Land Use Controls, paragraph 1** There may very well be conditions where surface soil or subsurface soil may require land use controls. This alternative should not be eliminated.

**Page 7-4, Land Use Controls (deed restriction)** Clean soil cover should be measured for radioactivity concentrations before deposition so that no undesirable levels are reintroduced.

**Page 8-9, Section 8.3.5.1** Excavations should include Subsurface Soil as well. Information as included in Attachment I1 to Appendix I show that there can be considerable fly ash at substantial depths. This can be intruded into as when the Pines Town Hall was built. All contaminated soil should be removed from the outset so that future exposures are foreclosed and there will be no need to remobilize to remove contaminated soil in the future.

**Page 8-10, paragraph 1** Future land use cannot be anticipated with any certainty so that contaminated soil should be removed completely from the outset to prevent unexpected exposures and to prevent the need to remobilize excavation crews should contaminants be encountered.

**Page 8-10, paragraph 2** Deed restrictions are not easy to control and should be questioned as to whether they may be a form of "taking."

**Page 8-10, paragraph 3** Off-site fill should be analyzed to ensure it does not exceed criteria.

Restitution should include restoring the property to an " as was" state since decontamination activities may alter or eliminate features or personal property of the owner.

**Page 8-37, paragraph 2** Materials transported to an offsite landfill should meet the radioactivity requirements of that site as well as the chemical requirements.

**Page 9-4, paragraph 1** For radioactivity, it may not be necessary to excavate the entire 100 $m^2$ if a correspondence is developed between meter count rate and soil radioactivity. This was done with the USEPA West Chicago and Streeterville sites with much savings in labor and disposal costs.

**Attachment I1 to Appendix I** Missing items include; the relevant maps of USGS Report 83-4271 showing where fly ash deposition to 5 feet occurred ; the map provided by USEPA to respondents in January 2004.

**Attachment I3 to Appendix I** Results of the leach test referred to in the Calumet Trucking Company letter of April 2, 1976, is missing from this section.

**Appendix G, Section 1, paragraph 2** It is prudent to take measurements at peak points on properties so as to identify maximum conditions. This conforms to assurances given by the former Yard 520 Project Manager, Timothy Drexler.

**Appendix G, Section 1, paragraph 3** 2000 $m^2$ greatly exceeds the criterion area of the mill tailings standards in 40 CFR 192.12 of 100 $m^2$. The 100 $m^2$ area should be used.

Statements for numbers of background sites and properties should be definite, not "approximately."

Appendix F1 was located in the Appendices section but no F2 was located. This essential section appears to be missing.

**Appendix G, Section 1, paragraph 4** No explanation is given for using a minimal detectable activity of 2.5 pCi/g. This is several times above the Ra-226 background reported in this FS. In Table 2 – Validated Soil Sampling Analytical Resuts - there are 11 unestimated Ra-226 data points with an mean of 0.360 pCi/g. The minimum detectable activity should not exceed 0.360 pCi/g.

**Appendix G, Section 3.1, paragraph 2** Figures 2a, 2b, 2c and Table 1 were not provided.

**Appendix G, Section 3.2, Sample Collection** Collecting samples as described can very likely miss critical exposure points. Samples should be collected at points of peak count rate and peak dose rate. This conforms to assurances by the former Yard 520 Project Manager to use peak values in calculating dose effects, such as in the HHRA.

Procedures developed at the USEPA Region 5 sites in West Chicago and Streeterville were proven to be extremely effective in locating and removing all contaminants of concern. It is unclear why they were not considered for this site as well

# Appendix A

# SITE ASSESSMENT REPORT

WEAVER BOOS CONSULTANTS

August 21, 2012
Project #0013-01-01

Indiana Department of Environmental Management
Office of Land Quality
Solid Waste Permitting & Compliance
100 North Senate Ave.
Mail Code 65-45
Indianapolis, IN 46204-2251
Attn: Ms. Alicia Brown

**Re: Site Assessment Report**
**Yard 520 Restricted Waste Site (RWS Type II)**
**FP# 64-04**
**Porter County**

Dear Ms. Brown:

On behalf of our client, permittee, Yard 520 RWS, Weaver Boos Consultants North Central, LLC (Weaver Boos) is herein submitting the above referenced report. Two paper copies and one electronic copy on CD of the enclosed report are being transmitted in accordance with the Site Assessment Plan prepared by Weaver Boos, dated November 19, 2010, which was approved by IDEM in a letter dated May 17, 2011.

We trust that the above is sufficient for your current needs. Feel free to contact our office should you have any questions concerning this matter.

Sincerely,

**Weaver Boos Consultants North Central, LLC**

Michael B. Maxwell, LPG
Senior Project Manager

Enclosures

cc: Ms. Val Blumenfeld (w/ encl.)

**August 21, 2012**
**Project No.: 0013-01-01**

# SITE ASSESSMENT REPORT
# Yard 520 RWS
# Town of Pines, Indiana

Prepared For:

**Yard 520 Restricted Waste Site**
**720 W. U.S. Highway 20**
**Michigan City, Indiana 46360**

Submitted to:

**Ms. Alicia Brown**
**Office of Land Quality**
**Indiana Department of Environmental Management**
**100 North Senate Avenue**
**Mail Code 65-45 IGCN 1101**
**Indianapolis, Indiana 46204**

**SITE ASSESSMENT REPORT**
**YARD 520 RWS**

## TABLE OF CONTENTS

**SITE ASSESSMENT REPORT**
**YARD 520 RWS**

# TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF GRAPHS



## LIST OF FIGURES

**SITE ASSESSMENT REPORT**
**YARD 520 RWS**

## TABLE OF CONTENTS

## LIST OF APPENDICES

# 1.0 INTRODUCTION

Weaver Boos Consultants North Central, LLC (Weaver Boos) has prepared the following Site Assessment Report (Report) on behalf of permittee, Brown, Inc. for the Yard 520 Restricted Waste Site (RWS). The Yard 520 RWS is located in Porter County, Indiana and is comprised of the following two areas separated by a subsurface clay barrier wall:

- Type II Area – North Area which has been certified as closed by the Indiana of Department of Environmental Management (IDEM) and is regulated under 329 IAC 10-31 and an Approval of Supplemental Closure/Post-Closure Plan correspondence from IDEM dated August 5, 2005; and
- Type III Area – South Area which was certified as closed by IDEM in a letter dated August 1, 2005. The Type III Area is regulated under IDEM Permit FP#64-07 dated September 3, 2003.

This Report presents the results from the implementation of a year-long Site Assessment Plan (Plan) intended to investigate hydrogeologic conditions on the southwest side of the Type II Area in response to conditions noted during an inspection by the Indiana Department of Environmental Management (IDEM) in 2010. The Report is being submitted in accordance with the Plan submitted to IDEM in a letter from Weaver Boos dated November 19, 2010 and subsequently approved in a letter from IDEM dated May 17, 2011. This Report summarizes the work conducted to address issues raised by IDEM concerning this area, as well as provides recommendations for follow-up actions.

Included with this Report are summary tables containing groundwater and precipitation data, tables summarizing the cap thickness assessment, groundwater elevation contour maps, piezometer installation diagrams and soil boring logs.

## 2.0 BACKGROUND

A letter to the permittee from IDEM dated October, 7 2010 provided results from an inspection of the facility conducted by IDEM during the summer of 2010. This letter indicated that a site assessment was required and the findings were to be submitted to Alicia Brown in the solid waste permits section of IDEM, for engineering and geology review. In response to the October 7, 2010 letter, a Site Assessment Plan was developed to investigate the area of concern identified by IDEM and recommend follow-up remedial actions, if appropriate. This Plan was submitted to IDEM in a letter from Weaver Boos dated November 19, 2010. The Plan was subsequently approved by IDEM in a letter dated May 17, 2011.

A follow-up facility inspection was conducted by IDEM on July 18, 2011. A secondary violation was issued based upon conditions observed during this inspection in a letter to the permittee from IDEM dated July 28, 2011. This letter stated a seep was observed along the southwest portion of the north fill extending from midslope to the base of the fill near Birch Street. The letter went on to state "compliance must be achieved by implementing landfill repairs to control the outbreak of leachate from the seep" within 30 days of receipt of the letter. A response to IDEM's July 28, 2011 letter was submitted by Weaver Boos on behalf of the permittee dated August 24, 2011. Within this letter, IDEM was notified of measures taken to address this condition, while the year-long assessment was in progress. These measures included:

1. Grass clippings that had accumulated and matted in the area of concern were raked and removed;
2. Upon removal of the grass clippings, because this area contained sparse vegetation, a layer of black topsoil was added and subsequently re-seeded;
3. This area will be mowed with a smaller mower and excess grass accumulating in this area will be removed, so as to minimize moisture retention at the surface and increase the potential for the ground to air dry; and
4. The area was regularly monitored to assess vegetation growth until vegetation re-established itself.

These measures were considered sufficient to address the condition, prior to the completion of the year-long data collecting assessment. The above mentioned letters from IDEM are included

in **Appendix A** and a copy of the November 19, 2010 Site Assessment Plan and IDEM approval letter are included in **Appendix B**.

## 3.0 FIELD ACTIVITIES

The Site Assessment field activities were implemented in accordance with the November 19, 2010 Plan and consisted of the following:

- Installation of three temporary piezometers on July 20, 2011;
- Advancement of four soil probes to assess cap thickness on July 20, 2011; and
- One year of monthly groundwater elevation measurements conducted from July 2011 to June 2012.

### 3.1 Piezometer Installation

Three piezometers (labeled PZ-1, PZ-2, and PZ-3) were installed on July 20, 2011 in accordance with the Site Assessment Plan. Enviro-Dynamics, Inc. of Hebron, Indiana installed the piezometers utilizing a track mounted Geoprobe® system. Piezometers were installed to a depth of twelve (12) feet below ground surface (bgs) and soil samples were continuously obtained and logged by qualified Weaver Boos personnel from the ground surface to the termination depth. The chosen locations of the three piezometers were based on the identified area of concern in the two IDEM letters dated October 7, 2010 and July 28, 2011, specifically along the southwestern portion of the Type II fill area along Birch Street. Piezometer construction diagrams and soil boring logs are found in **Appendix C.**

On July 27, 2011 the three piezometers were surveyed to the nearest foot using the state plane coordinate system. The elevation of the ground, top of inner PVC casing and top of outer steel casing was also surveyed to the nearest 0.01 foot relative to a known elevation datum historically utilized at the facility. The locations of these piezometers is shown on **Figure 1**. Survey data for the new piezometers may be found in **Table 1**.

### 3.2 Cap Thickness Assessment

Four soil probes (labeled GP-100, GP-101, GP-102, and GP-103) were advanced on July 20, 2011 upslope of the area of concern to assess the thickness and condition of the final cover layer in accordance with the Site Assessment Plan. Enviro-Dynamics, Inc. of Hebron, Indiana advanced the probes utilizing a track-mounted Geoprobe® system. The soil probes were advanced to depths of 4-5 feet below ground surface. Upon completion, the probes were backfilled with granular bentonite to the ground surface. A table summarizing the materials encountered, their

depth, soil pH, and effervescence is presented as **Table 2**. Locations of the four soil probes is shown on **Figure 1**.

On July 27, 2011 the four soil probe locations were surveyed to the nearest foot using the state plane coordinate system. The elevation of the ground was also surveyed to the nearest 0.01 foot relative to a known elevation datum historically utilized at the facility. Survey data for the soil probes is found in **Table 1**.

### 3.3 Groundwater Elevation Measurements

Weaver Boos personnel collected groundwater level measurements once a month for twelve (12) months in accordance with the Site Assessment Plan beginning July 20, 2011 and concluding June 23, 2012. Water levels were collected consistently during the third or fourth week of every month for the duration of the year-long assessment. A total of nineteen (19) monitoring wells, temporary wells, and piezometers were included in this scope, as follows:

| Monitoring Wells | Temporary Wells | Piezometers |
|---|---|---|
| MW-1R | TW-15S | P-2 |
| MW-5 | TW-16S | P-10 |
| MW-6 | TW-17S | PZ-1 |
| MW-7 | TW-18S | PZ-2 |
| MW-8 | TW-19S | PZ-3 |
| MW-10 | | |
| MW-11 | | |
| MW-13S | | |
| MW-14S | | |

The monitoring well network construction details and groundwater elevations over the one-year period are summarized on **Table 3**. The groundwater elevation measuring points were chosen from monitoring points screened at the shallow zone aquifer, consistent with the screened depth intervals of the newly installed piezometers, PZ-1, PZ-2, and PZ-3. Note that MW-1R is screened in the deeper portion of the uppermost aquifer and was not used in constructing the groundwater elevation contour maps for the upper portion of the uppermost aquifer.

# 4.0 SITE ASSESSMENT DATA

## 4.1 Groundwater Data

Weaver Boos collected depth-to-groundwater level measurements from nineteen (19) monitoring points, including the newly installed piezometers, for twelve (12) consecutive months in accordance with the Site Assessment Plan. Groundwater elevation data acquisition began in July, 2011 and concluded June, 2012. Upon completion of each event, a groundwater elevation contour map was produced; twelve maps were produced in total, one for each month. The groundwater flow and gradient are illustrated on the contour maps provided as **Figures 2** through **Figure 13**.

The contour maps indicate that the dominant groundwater flow direction over the east portions of the Type II Area is generally to the east/southeast throughout the year. The gradient over the east portions of the Type II Area is approximately 0.014. Shallow groundwater flowing beneath the east portions of the Type II Area ultimately discharges to Brown Ditch east of Yard 520.

On the west side of the Type II Area, groundwater elevations observed at MW-13S, MW-14S, and MW-7 during individual monitoring events are generally similar. Thus, the gradient over the northwestern portion of the Type II Area is relatively flat. However, the groundwater gradient increases beneath the southwest portions of the Type II Area, closer to the subsurface clay barrier wall separating the Type II and Type III areas. Groundwater flow in the area of concern appears to be controlled by groundwater elevations observed at PZ-2, which represents a local groundwater high. Shallow groundwater flow from PZ-2 is generally either to the northeast (generally parallel to the clay barrier wall), towards P-2, or to the northwest, west, and southwest, in the general direction of Birch Street. Thus, a portion of the groundwater beneath the western areas of the Type II RWS flows back towards the east portions of the Type II Area, and ultimately discharges to Brown Ditch east of Yard 520. Additionally, a portion flows beneath Birch Street and discharges to the low lying area west of Birch Street (which is believed to ultimately drain into Brown Ditch west of Yard 520).

## 4.2 Precipitation Data

Precipitation data was accessed through the National Oceanic and Atmospheric Administration's (NOAA) National Climactic Data Center (NCDC) website [http://www.ncdc.noaa.gov/cdo-web/] and is summarized in **Table 4**. The NOAA rain station which regularly collects daily rain and

snow data that was identified as closest to Yard 520 was utilized (NOAA Station Chesterton 1.4 ENE in Chesterton, Indiana). NOAA Station Chesterton 1.4 ENE is located approximately 6 miles southwest of the Yard 520 RWS, as illustrated in **Appendix D.**

The precipitation data from NOAA Station Chesterton 1.4 ENE for each month was summed together; ten (10) inches of snow was considered equivalent to one inch of rain. The monthly data is presented graphically in **Graph 1**; the raw downloaded data may be found in **Appendix E**. The greatest quantity of precipitation in the Chesterton-Michigan City area during the period of observation occurred during July, 2011 with an atypical total of 6.43 inches; approximately 2.3 inches higher than the monthly average. The precipitation, in general, gradually decreased over the year-long observation time. Two increases in precipitation were observed in the months of September, 2011 and January, 2012 with monthly totals of 3.43 and 3.24 inches, respectively. The yearly observed low occurred in April, 2012 with 0.92 inches of recorded precipitation; approximately 2.6 inches lower than the monthly average.

### 4.3 Cap Condition Assessment

As discussed above, four soil probes were advanced upslope of the area of concern to evaluate the condition and thickness of the final cover layer. The soil-probe data includes the thickness, pH, and effervescence of each layer of material encountered (see **Table 2**). Each probe was advanced to a maximum depth of five feet to assess the cap thickness and current condition. The newly installed piezometers were also utilized to assess the condition of the final cover.

The soil probes exhibited a compacted clay layer thickness ranging from 2.5 to 3 feet and a top soil layer thickness ranging from 1 to 1.5 feet. The piezometer soil borings exhibited a slightly thicker compacted clay layer ranging from 2 to 5 feet and a top soil thickness of 1 foot. A healthy vegetative cover, generally free of stress, was apparent at each probe/piezometer location. The compacted clay layer was generally composed of brown silty clay and the top soil was composed of organic rich dark brown to black 'O' horizon soil. The pH of the soil layers ranged from 7.38 to 7.91. Effervescence testing exhibited a wide range of results. The top soil was in general more effervescent than the compacted soil layer.

# 5.0 ASSESSMENT OF THE DATA

## 5.1 Groundwater Flow

Groundwater flow in the vicinity of the Yard 520 RWS is controlled by surface topography and the subsurface clay barrier wall separating the Type II and III Areas of Yard 520. In general, groundwater flows from the north to the south and southeast. Generally, wells to the north and west exhibit the higher groundwater elevations, while wells to the east exhibit lower groundwater elevations. A divide in the groundwater flow was observed beneath the western portion of the Type II Area; water east of the divide flows to the east, ultimately discharging to Brown Ditch east of Yard 520, and water west of this divide flows to the west towards the low lying areas on the west side of Birch Street. Monitoring points P-2 and PZ-2 were controlling factors in groundwater flow throughout the duration of the year-long assessment. Groundwater elevations at piezometer PZ-2 are anomalously high with respect to neighboring monitoring points and this impacts groundwater flow by redirecting it towards the northeast (generally parallel to the clay barrier wall), northwest, west, and southwest in the southwest corner of the Type II Area; the area of concern (see **Figures 2** through **Figure 13**).

The majority of the groundwater monitoring locations included in the year-long study were located outside the boundaries of the area containing final cover. Outside the boundaries of the Yard 520 RWS, the soils are comprised primarily of sands and therefore, the aquifer conditions are generally considered unconfined. By contrast, piezometers P-2, PZ-1, PZ-2, and PZ-3 were installed through the compacted clay layer serving as the final cover for Yard 520 and consequently appear to represent confined aquifer conditions. This explains why an elevated head is observed at some of these locations. These piezometers are screened below thick layers of clay; P-2 is installed along the subsurface clay barrier wall separating the two fill areas and PZ-2 is installed on the slope of the Type II fill area. The clay unit appears to be acting as a confining unit subjecting PZ-2 and P-2 to different hydraulic controls than the majority of the other monitoring points, which typically demonstrate unconfined aquifer characteristics. This will be explored in greater detail in the following sections.

## 5.2 Patterns in Groundwater Elevation Over Time

The monthly groundwater elevation data reveals several trends in the behavior of the groundwater elevation surface over time (see **Graph 2)**. During the year-long assessment, the water table was generally lower during the growing season (i.e., May through October) and

higher during the winter months (i.e., December through February). This is believed to be attributed to one or more of the following:

1. Changes in evapotranspiration rates;
2. Changes in soil moisture content; and
3. Changes in the amount of surface water runoff.

Exceptions to this general pattern are observed at piezometers PZ-2 and P-2, which appear to exhibit confined aquifer characteristics, rather than unconfined (water table) conditions. The confined aquifer near PZ-2 and P-2 displays a different rate of groundwater recharge and discharge, compared to the unconfined aquifer at other locations. This effect was more pronounced at PZ-2, but P-2 did demonstrate this as well, especially during the winter months. As can be seen in **Graph 3**, PZ-2 displayed almost artesian like behavior (consistent with confined conditions) over portions of the year, maintaining a groundwater elevation above ground surface for much of the period of observation, except during the last few months, when the potentiometric surface decreased below the ground surface.

### 5.3 Connection Between Precipitation Data and Groundwater Data

Comparing precipitation data to the groundwater elevation data; the rate of infiltration during the period of observation remained relatively constant, see **Graph 2**. This is expected for normal unconfined aquifer conditions, when the aquifer is recharged directly from the ground surface above. In general, the patterns in groundwater elevations were closely tied to changes in precipitation. Increases or decreases in precipitation resulted in corresponding changes in the groundwater elevation almost simultaneously.

Two monitoring points, however, displayed a different response to the infiltration of meteoric water (i.e., PZ-2 and P-2). While the groundwater elevation changes at the other monitoring points generally occurred together with changes in precipitation, the patterns in potentiometric surface at PZ-2 and P-2 were not as closely tied to precipitation. In general, it appears that a lag-time is observed between the increased/decreased precipitation and the corresponding change in potentiometric surface at these piezometers. This is likely attributable to the confined aquifer conditions present at these piezometers.

The higher than average rainfall during the early summer of 2011 (see **Graph 1** and discussion in Section 4.2) is attributed as a critical factor to the unusually high groundwater elevation observed

in PZ-2 following periods of unusually high precipitation. As has been mentioned, the confined conditions at these locations create a higher pressure head because the confined aquifer can not discharge in the same manner as the unconfined portions of the aquifer. Additionally, the subsurface clay barrier wall located near PZ-2 tends to inhibit natural groundwater flow away from this general area, which is another likely factor related to the abnormally high groundwater elevations observed at PZ-2. However, as precipitation continued to decline back to normal levels and subsequently below normal levels during the first half of 2012, the groundwater levels also have eventually dropped, enough so, that the potentiometric surface at PZ-2 dropped back below the ground surface (see **Graph 3**). The lag-time effect is evident in the potentiometric surface elevation at PZ-2 during 2012. While precipitation has increased since April 2012, the potentiometric surface at PZ-2 has steadily declined during the same time period. Prior patterns suggest that the potentiometric surface at PZ-2 will likely eventually increase in response to the increases in precipitation observed during the spring and early summer of 2012.

### 5.4 Condition of Final Cover

According to 329 IAC 10-30-3, the minimum requirements for a final cover layer for a Type II Restricted Waste Site consists of the following (from the bottom up):

- Two feet of compacted clay;
- Six inches of top soil; and
- Vegetative cover.

The results from the soil probes and soil borings associated with the new piezometers within the area of concern indicate the minimum final cover requirements are exceeded in each category. The compacted clay layer was found to exceed the minimum thickness by a factor of up to 2.5. This is especially true in the area of concern where the soil boring for PZ-2 and soil probes GP-100 and GP-101 exhibit a clay layer thickness ranging from three feet (GP-100) to five feet (PZ-2). The top soil layers were also found to exceed the minimum by a factor of up to three. In the area of concern, it was found that the topsoil layer ranged from one foot (PZ-2 and GP-11) to 1.5 feet (GP-101).

Additionally, the vegetative cover of the Type II fill area is in excellent condition; no large patches of dead or stressed vegetation were observed and no deep-rooted vegetation is present that could compromise the integrity of the compacted clay layer. The excellent condition of the vegetation

allows for sufficient erosion protection from water and wind, as well as promoting evapotranspiration, further reducing the amount of water infiltrating the RWS.

### 5.5 Source of Condition Observed at Area of Concern

The area of concern observed in the southwest corner of the Type II fill appears to be the result of several factors including, but not limited to the following:

- Atypically high quantities of precipitation during certain times of the year;
- Confined aquifer conditions in proximity of the area of concern; and
- Presence of the subsurface clay barrier wall in proximity of the area of concern, which appears to inhibit/slow down local groundwater movement away from the area of concern.

In an attempt to gain a better understanding of precipitation patterns in northern Indiana, Weaver Boos accessed the NOAA-NCDC to obtain data dating back to December, 2009 to compare the precipitation rates to the timing of the notifications from IDEM concerning this issue. Augmenting **Graph 1** (see **Graph 4**), the times of the IDEM notices were plotted against the recorded precipitation and the monthly averages from December, 2009 to June, 2012. As can be seen, each IDEM notice occurred after periods of abnormally high precipitation. The September, 2010 notification was preceded by precipitation totaling 3.72 inches above the monthly average, while the July, 2011 notification was preceded by three months of abnormally high rates of precipitation. The appearance of the noted conditions appears to be related to periods of abnormally high rain coupled with the confined aquifer conditions and proximity of the area of concern to the clay barrier wall, which inhibits natural groundwater flow away from the area, apparently resulting in a temporary localized groundwater high. Based on the data collected during this site assessment, the noted conditions are only expected to be observed in response to periods of abnormally high precipitation.

## 6.0 CONCLUSIONS

Weaver Boos has implemented a year-long Site Assessment of the Yard 520 RWS in Porter County, Indiana to investigate hydrogeologic conditions on the southwest side of the Type II Area in response to an area of concern noted during an inspection by IDEM in 2010. This Report summarizes the work conducted to address issues raised by IDEM concerning this area, as well as provide recommendations for follow-up actions. The Report is being submitted in accordance with the Plan submitted to IDEM in a letter dated November 19, 2010 and subsequently approved in their response dated May 23, 2011.

In accordance with the Plan, the following tasks were undertaken:

- Installation of three new piezometers;
- Advancement of four soil probes to assess the condition of the final cover layer;
- Twelve consecutive months of groundwater elevation measurements; and
- Analysis of precipitation data from local NOAA weather stations.

An assessment of the final cover layer of the landfill was conducted utilizing the soil logs for the new piezometers and the advancement of four soil probes upslope of the three temporary piezometers. The assessment identified the Yard 520 final cover layer surpassing each minimum requirement by a factor of up to 2.5 in several cases. The vegetation component of the final cover was also in good condition, promoting adequate protection from erosion as well as promoting evapotranspiration.

Depth-to-groundwater level measurements were collected for twelve (12) months from nineteen (19) monitoring wells, temporary wells, and piezometers. From this data, twelve groundwater contour elevation maps were produced allowing for an investigation of the hydrogeologic conditions of the Site. The investigation revealed that the hydrogeology of the area surrounding Yard 520 is generally consistent with an unconfined aquifer. Within areas exhibiting unconfined aquifer conditions, constant rates of recharge and discharge related to patterns of infiltration from precipitation were observed. Two areas were, however, exceptions to the rest. Piezometers PZ-2 (located in the area of concern) and P-2 (located along the clay barrier wall separating the northern and southern fills) exhibited characteristics more consistent with a confined aquifer.

The confined nature of PZ-2 lends a different set of hydraulic controls on the groundwater in the area of concern, creating different conditions than the surrounding unconfined groundwater.

Precipitation data obtained from NOAA Station Chesterton 1.4 ENE was analyzed to assess the relationship between precipitation and groundwater elevation at the Site. The analysis revealed that the site has received abnormally high amounts of precipitation during the last two summers in relation to the monthly average. This was particularly true prior to each site visit conducted by IDEM where the area of concern was identified. The high amount of precipitation coupled with the confined aquifer conditions at PZ-2 and the close proximity of the clay barrier appears to have created a localized high pressure head in the area. It appears these conditions drove the formation of the noted conditions identified in the area of concern. It should be noted however that the precipitation rates that result in the noted condition are abnormal and not expected to be seen on a regular basis.

# 7.0 RECCOMENDATIONS

The following presents a list of proposed remedial actions resulting from the year-long assessment conducted on the Site. The recommendations have been designed to meet the concerns of IDEM previously stated in the report.

- One additional year of regular groundwater elevation measurements, together with compilation of local precipitation data; and
- Additional action/repairs within the area of concern.

Further discussion concerning the above recommendations is presented in the following sections.

## 7.1 Additional Groundwater Elevation Measurements

The year-long assessment conducted by Weaver Boos elucidated a probable cause for the observed area of concern in the southwest corner of the Type II fill. The condition is believed to be attributed to a combination of abnormally high amounts of precipitation coupled with confined aquifer conditions present near the subsurface clay barrier that inhibits groundwater flow away from the area of concern. As a result, this condition is not expected to occur, except following periods of abnormally high precipitation. An additional year of regular groundwater levels and precipitation data is recommended as a follow-up action. Groundwater levels will be collected at evenly spaced intervals at least eight different times during the upcoming year. A progress report will be submitted to IDEM containing the groundwater elevation and precipitation data, along with recommendations for further action, if appropriate. The report will be submitted within 60 days after the end of the next year-long period, which will be assumed to run from August 2012 to August 2013.

## 7.2 Addition Action/Repairs

The permittee will visually inspect the area of concern for evidence of moisture at the surface at least once per month during the next year. If future precipitation levels over the next year greatly exceed the monthly average, the permittee will take the following measures to control potential future outbreaks (should they be observed):

- Grass clippings that may accumulate and mat in the area of concern will be raked and removed;

- If localized areas of sparse/absent vegetation are observed, a layer of topsoil will be added and subsequently reseeded (weather permitting);
- If reseeding is needed, the area will be regularly monitored to assess vegetation growth until vegetation re-establishes itself;
- The area will be mowed with a smaller mower and excess grass potentially accumulating will be removed, with the intent being to minimize surface moisture retention and increase the effectiveness for the ground to air dry; and
- If soil in the area remains saturated for an extended period of time, the west soil will be removed and replaced with clean, dry clayey soil and reseeded as described above (weather permitting).

# Tables

**Table 1**
**Yard 520 Restricted Waste Site**
**Piezometer and Soil Probe Locations**
**Survey Date: July 27, 2011**

| PIEZOMETER/GAS PROBE | NORTHING | EASTING | EXISTING GROUND ELEVATION | CONCRETE ELEVATION | TOP OF CASING ELEVATION | TOP OF CASING (OPENED) ELEVATION* | TOP OF INNER PVC ELEVATION* |
|---|---|---|---|---|---|---|---|
| PZ-1 | 2341738.51 | 2985857.78 | 617.93 | 617.87 | 621.52 | 621.14 | 621.03 |
| PZ-2 | 2341664.39 | 2985862.68 | 619.55 | 619.60 | 623.10 | 622.46 | 622.35 |
| PZ-3 | 2341482.86 | 2985881.53 | 617.86 | 618.00 | 621.63 | 621.12 | 620.95 |
| GP-100 | 2341684.65 | 2985923.64 | 633.11 | N/A | N/A | N/A | N/A |
| GP-101 | 2341662.21 | 2985926.59 | 632.58 | N/A | N/A | N/A | N/A |
| GP-102 | 2341690.27 | 2985975.98 | 636.14 | N/A | N/A | N/A | N/A |
| GP-103 | 2341785.07 | 2985970.43 | 639.66 | N/A | N/A | N/A | N/A |

*Leveled Elevation

**Table 2**
**Yard 520 Restricted Waste Site**
**Cap Assessment Table**

| Soil Probe | Soil Decription | Thickness | Effervescence pH |
|---|---|---|---|
| GP-100 | Vegetation, Top Soil | 1 Foot | Effervescent 7.91 |
| | Brown Silty Clay, Some Gravel, Trace Orange-Blueish Gray Mottling | 3 Feet | Very Effervescent 7.72 |
| GP-101 | Vegetation, Top Soil | 1.5 Feet | Effervescent 7.84 |
| | Brown Silty Clay, Trace Gravel, Few Orange and Blueish-Gray Mottling | 3.5 Feet | Very Effervescent 7.64 |
| GP-102 | Vegetation, Top Soil | 1.5 Feet | Effervescent 7.72 |
| | Light Brown-Tan Silty Clay, Trace Faint Orange Mottling | 2.5 Feet | Very Effervescent 7.38 |
| | Dark Brown Silty Clay | 1 Foot | Non-Effervescent 7.49 |
| GP-103 | Vegetation, Top Soil | 1 Foot | Non-Effervescent 7.92 |
| | Light Brown Silty Clay, Trace Gravel, Trace Orange and Blueish-Gray Mottling | 3 Feet | Very Effervescent 7.81 |
| | Dark Brown Silty Clay | 1 Foot | Non-Effervescent 7.67 |

**Table 3**
**Yard 520 Restricted Waste Site**
**Monitoring Well Network Monthly Groundwater Data**

| Well ID | Facility Monitored | Up/Down Gradient | Well Diameter (inches) | Location | | Elevations (MSL) | | | Elevation of Groundwater Surface (MSL) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Northing | Easting | Top of Procover | Top of PVC | Ground | 07-2011 | 08-2011 | 09-2011 | 10-2011 | 11-2011 | 12-2011 | 01-2012 | 02-2012 | 03-2012 | 04-2012 | 05-2012 | 06-2012 |
| *Monitoring Wells* | | | | | | | | | | | | | | | | | | | | | |
| MW-1R | Type II | up | 2 | 2342181.85 | 2985885.47 | 626.48 | 625.81 | 624.06 | 618.35 | 617.37 | 616.59 | 616.73 | 616.74 | 617.05 | 616.89 | 616.67 | 616.83 | 616.09 | 615.97 | 615.32 |
| MW-5 | Type II | NA | 2 | 2342880.34 | 2987478.67 | 610.36 | 610.19 | 608.90 | 607.16 | 606.92 | 606.92 | 607.05 | 607.31 | 607.44 | 607.52 | 607.51 | 607.41 | 607.11 | 606.98 | 605.87 |
| MW-6 | Type II | side | 2 | 2342964.71 | 2986858.11 | 632.12 | 631.59 | 628.87 | 616.85 | 615.90 | 615.12 | 615.13 | 615.26 | 615.17 | 615.26 | 615.13 | 615.16 | 614.71 | 614.54 | 614.07 |
| MW-7 | Type II | side | 2 | 2342646.50 | 2986507.53 | 630.28 | 629.83 | 624.90 | 618.47 | 617.33 | 616.48 | 616.55 | 616.76 | 616.52 | 616.65 | 616.47 | 616.60 | 616.04 | 615.79 | 615.26 |
| MW-8 | Type II | down | 2 | 2342554.26 | 2987401.46 | 616.31 | 615.84 | 612.40 | 606.20 | 605.78 | 605.69 | 606.51 | 606.43 | 606.65 | 607.09 | 606.53 | 606.75 | 606.23 | 606.03 | 605.50 |
| MW-10* | Type II | NA | 2 | 2341599.02 | 2985821.03 | 616.74 | 615.98 | 614.50 | 612.52 | 612.31 | 612.26 | 612.47 | 612.57 | 612.57 | 612.62 | 612.58 | 612.62 | 612.41 | 612.26 | 612.00 |
| MW-11 | Type II | down | 2 | 2343020.71 | 2987440.39 | 612.45 | 611.97 | 609.60 | 607.56 | 607.22 | 606.07 | 607.88 | 608.00 | 608.06 | 608.20 | 608.12 | 608.04 | 607.76 | 607.58 | 606.50 |
| MW-13S* | Type II | up | 2 | 2342422.51 | 2986011.01 | 627.74 | 626.97 | 625.50 | 618.80 | 617.77 | 616.89 | 617.03 | 616.75 | 616.95 | 617.07 | 616.86 | 616.99 | 616.47 | 616.30 | 615.79 |
| MW-14S* | Type II | up | 2 | 2342688.04 | 2986314.00 | 628.46 | 627.78 | 626.10 | 618.56 | 617.49 | 616.61 | 616.67 | 616.42 | 616.63 | 616.67 | 616.52 | 616.62 | 616.15 | 615.93 | 615.40 |
| TW-15S | Type II | NA | 2 | 2343007.38 | 2986696.01 | 630.43 | 629.60 | 628.00 | 617.04 | 616.68 | 615.36 | 615.46 | 615.21 | 615.49 | 615.51 | 615.42 | 615.47 | 615.03 | 614.73 | 614.28 |
| TW-16S | NA | NA | 2 | 2343443.09 | 2987253.13 | 632.12 | 631.38 | 630.00 | 613.67 | 611.75 | 612.12 | 612.18 | 612.26 | 612.42 | 612.46 | 612.46 | 612.46 | 612.14 | 611.98 | 611.47 |
| TW-17S | NA | NA | 2 | 2343239.73 | 2986720.55 | 634.08 | 633.42 | 631.90 | 616.52 | 615.55 | 614.75 | 614.81 | 614.70 | 614.89 | 614.89 | 615.41 | 614.84 | 614.46 | 614.29 | 613.75 |
| TW-18S | NA | NA | 2 | 2343480.95 | 2987037.93 | 637.10 | 636.41 | 634.80 | 614.87 | 613.80 | 613.06 | 613.11 | 613.16 | 613.34 | 613.36 | 613.34 | 613.38 | 612.98 | 612.82 | 612.28 |
| TW-19S | NA | NA | 2 | 2343597.60 | 2987392.25 | 633.25 | 632.81 | 630.30 | 612.53 | 611.65 | 611.01 | 611.17 | 611.29 | 611.45 | 611.47 | 611.51 | 611.55 | 611.22 | 611.08 | 610.49 |
| P-2 | Type II | NA | 2 | 2342114.84 | 2986770.99 | 622.41 | 621.78 | 619.66 | 619.07 | 617.30 | 616.29 | 616.67 | 617.08 | 618.09 | 619.09 | 618.23 | 618.10 | 617.15 | 616.50 | 615.29 |
| P-10 | Type II | NA | 1 | 2341608.06 | 2985822.07 | 617.62 | 617.04 | 614.50 | 612.62 | 612.37 | 612.33 | 612.55 | 612.64 | 612.63 | 612.72 | 612.68 | 612.71 | 612.47 | 612.33 | 612.24 |
| PZ-1 | Type II | NA | 1 | 2341738.51 | 2985857.78 | 621.52 | 621.03 | 617.93 | 614.21 | 614.10 | 613.90 | 614.18 | 614.34 | 614.39 | 614.61 | 614.46 | 614.49 | 613.17 | 613.93 | 613.47 |
| PZ-2 | Type II | NA | 1 | 2341664.39 | 2985862.68 | 623.10 | 622.35 | 619.55 | 620.22 | 620.41 | 619.78 | 620.41 | 620.75 | 620.90 | 621.06 | 620.64 | 621.05 | 620.59 | 620.23 | 619.32 |
| PZ-3 | Type II | NA | 1 | 2341482.86 | 2985881.53 | 621.63 | 620.95 | 617.86 | 614.48 | 612.16 | 612.10 | 613.00 | 613.02 | 613.96 | 613.95 | 613.40 | 613.52 | 612.86 | 612.70 | 612.23 |

Monitoring locations originally surveyed on Sept. 9, 2002 by Marbach, Brady & Weaver, Inc.
Monitoring locations MW-1, MW-6, MW-7, MW-11, and P-2 re-surveyed by Weaver Boos Consultants.
Monitoring locations PZ-1, PZ-2, and PZ-3 surveyed on July 27, 2011
*Formerly known as TW-13S and TW-14S.
NA - Not available.

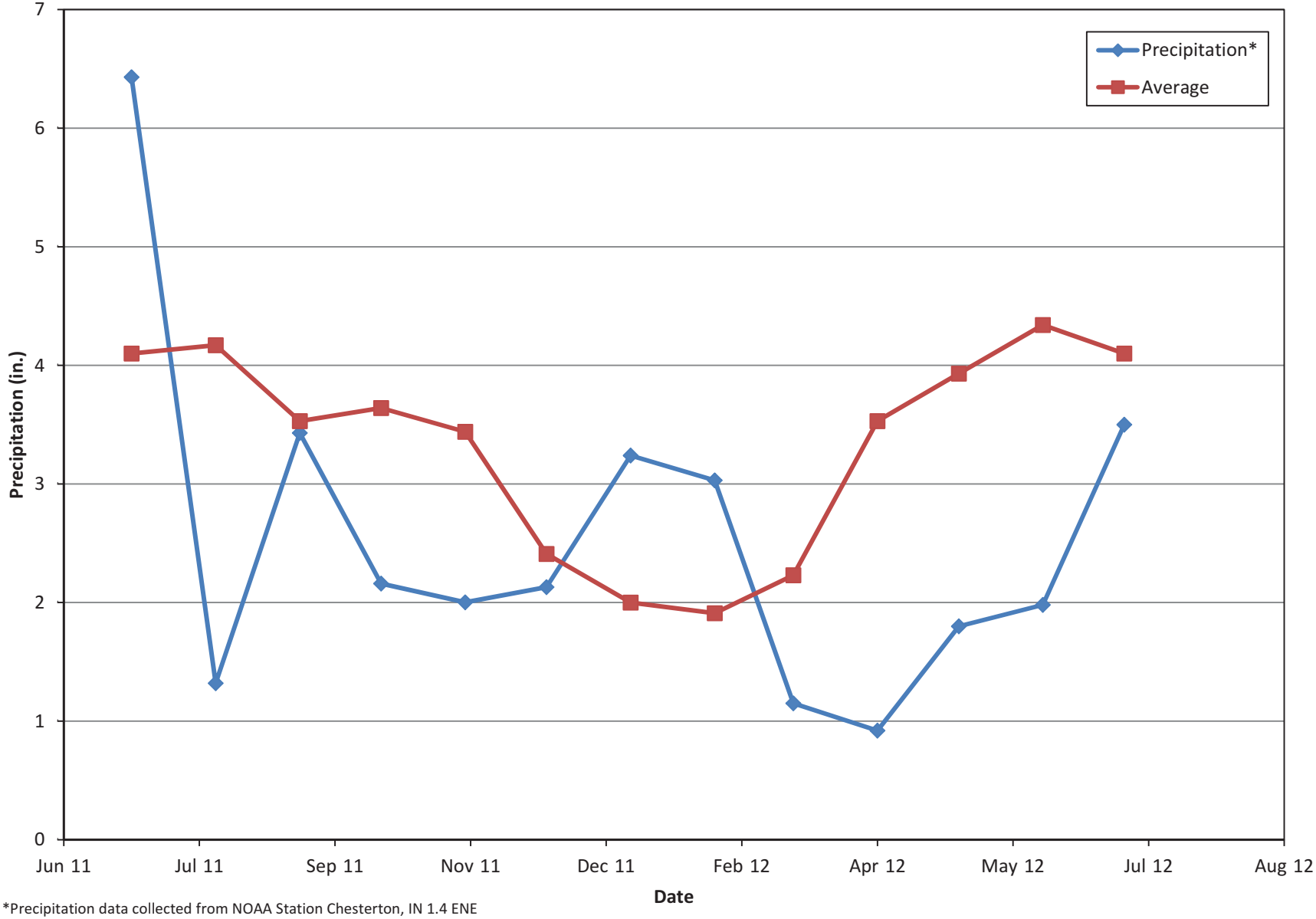
**Table 4**
**Yard 520 Restricted Waste Site**
**Daily Precipitation Recorded at Chesterton, IN**

| Day | Jul '11 | | | Aug '11 | | | Sept '11 | | | Oct '11 | | | Nov '11 | | | Dec '11 | | | Jan '12 | | | Feb '12 | | | Mar '12 | | | April '12 | | | May '12 | | | Jun '12 | | | July '12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Prec. | Snow | Total | Prec. | Snow | Total | Prec. | Snow | Total | Prec. | Snow | Total | Prec. | Snow | Total | Prec. | Snow | Total | Prec. | Snow | Total | Prec. | Snow | Total | Prec. | Snow | Total | Prec. | Snow | Total | Prec. | Snow | Total | Prec. | Snow | Total | Prec. | Snow | Total |
| **1** | 0.87 | NR | 0.87 | 0 | 0 | 0 | 0 | 0 | 0 | 0.03 | NR | 0.03 | 0 | 0 | 0 | 0 | 0 | 0 | NR | NR | NR | 0.01 | NR | 0.01 | T | NR | T | T | NR | T | 0.26 | NR | 0.26 | 0.69 | NR | 0.69 | NR | NR | NR |
| **2** | 3.27 | NR | 3.27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.05 | NR | 0.05 | 0.06 | 1.1 | 0.17 | 0 | 0 | 0 | 0 | 0 | 0 | 0.09 | NR | 0.09 | 0.07 | NR | 0.07 | 0.03 | NR | 0.03 | NR | NR | NR |
| **3** | T | 0 | T | 0.32 | NR | 0.32 | NR | NR | NR | 0 | 0 | 0 | 0 | 0 | 0 | T | NR | T | 0.02 | 0.6 | 0.08 | NR | NR | NR | 0.19 | NR | 0.19 | 0 | 0 | 0 | 0.01 | NR | 0.01 | T | NR | T | NR | NR | NR |
| **4** | 0 | 0 | 0 | NR | NR | NR | NR | NR | NR | 0 | 0 | 0 | T | NR | T | 0.1 | NR | 0.1 | 0 | 0 | 0 | 0.11 | T | 0.11 | T | 0 | T | 0 | 0 | 0 | 0.18 | NR | 0.18 | 0 | 0 | 0 | 0 | 0 | 0 |
| **5** | 0 | 0 | 0 | NR | NR | NR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.02 | NR | 0.02 | 0 | 0 | 0 | 0 | 0 | 0 | 0.09 | 3.5 | 0.44 | 0 | 0 | 0 | T | NR | T | 0 | 0 | 0 | 0 | 0 | 0 |
| **6** | 0 | 0 | 0 | T | NR | T | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.02 | NR | 0.02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **7** | T | NR | T | 0.01 | NR | 0.01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | T | NR | T | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.9 | NR | 0.9 | 0 | 0 | 0 | 0 | 0 | 0 |
| **8** | 0 | 0 | 0 | 0.37 | NR | 0.37 | 0 | 0 | 0 | 0 | 0 | 0 | 0.032 | NR | 0.032 | 0 | 0 | 0 | 0 | 0 | 0 | 0.04 | NR | 0.04 | 0.19 | NR | 0.19 | T | NR | T | 0.05 | NR | 0.05 | 0 | 0 | 0 | T | NR | T |
| **9** | 0 | 0 | 0 | 0.37 | NR | 0.37 | 0.1 | NR | 0.1 | 0 | 0 | 0 | 0.62 | NR | 0.62 | 0.07 | 1 | 0.17 | 0 | 0 | 0 | NR | NR | NR | 0.02 | NR | 0.02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | T | NR | T |
| **10** | 0 | 0 | 0 | 0 | 0 | 0 | 0.12 | NR | 0.12 | 0 | 0 | 0 | 0.11 | NR | 0.11 | T | T | T | 0 | 0 | 0 | NR | NR | NR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **11** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | T | NR | T | 0 | 0 | 0 | 0 | 0 | 0 | 0.38 | 5.4 | 0.92 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NR | NR | NR |
| **12** | 0.17 | NR | 0.17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | T | T | T | 0.21 | NR | 0.21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NR | NR | NR |
| **13** | T | NR | T | 0 | 0 | 0 | 0 | 0 | 0 | 0.07 | NR | 0.07 | 0 | 0 | 0 | 0 | 0 | 0 | 0.42 | 7.6 | 1.18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NR | NR | NR | 0 | 0 | 0 | NR | NR | NR |
| **14** | 0 | 0 | 0 | NR | NR | NR | NR | NR | NR | 1.22 | NR | 1.22 | 0 | 0 | 0 | 0.37 | NR | 0.37 | T | 0.7 | 0.07 | 0.05 | 0.9 | 0.14 | 0 | 0 | 0 | 0.09 | NR | 0.09 | NR | NR | NR | 0 | 0 | 0 | NR | NR | NR |
| **15** | 0 | 0 | 0 | NR | NR | NR | 0.09 | NR | 0.09 | 0 | 0 | 0 | 0.34 | NR | 0.34 | 1.01 | NR | 1.01 | T | T | T | 0 | 0 | 0 | 0 | 0 | 0 | 0.06 | NR | 0.06 | NR | NR | NR | 0 | 0 | 0 | NR | NR | NR |
| **16** | T | NR | T | NR | NR | NR | 0 | 0 | 0 | NR | NR | NR | 0 | 0 | 0 | T | NR | T | 0 | 0 | 0 | 0.17 | 0 | 0.17 | 0 | 0 | 0 | 0.41 | NR | 0.41 | NR | NR | NR | 0 | 0 | 0 | NR | NR | NR |
| **17** | NR | NR | NR | NR | NR | NR | NR | NR | NR | 0.07 | NR | 0.07 | 0 | 0 | 0 | 0.01 | 0.3 | 0.04 | 0.22 | NR | 0.22 | T | NR | T | NR | NR | NR | 0 | 0 | 0 | NR | NR | NR | 1.04 | NR | 1.04 | 0 | 0 | 0 |
| **18** | NR | NR | NR | NR | NR | NR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.02 | 0.2 | 0.04 | 0.08 | 0.8 | 0.16 | NR | NR | NR | 0.05 | NR | 0.05 | 0 | 0 | 0 | NR | NR | NR | 0 | 0 | 0 | 0 | 0 | 0 |
| **19** | 0 | 0 | 0 | NR | NR | NR | 0.97 | NR | 0.97 | 0.33 | NR | 0.33 | 0 | 0 | 0 | NR | NR | NR | 0.02 | 0.4 | 0.06 | NR | NR | NR | 0.03 | NR | 0.03 | 0 | 0 | 0 | NR | NR | NR | 0 | 0 | 0 | 2.27 | NR | 2.27 |
| **20** | 0.03 | NR | 0.03 | NR | NR | NR | T | NR | T | NR | NR | NR | 0 | 0 | 0 | NR | NR | NR | NR | NR | NR | NR | NR | NR | 0.02 | NR | 0.02 | 0.02 | NR | 0.02 | NR | NR | NR | 0 | 0 | 0 | 0.09 | NR | 0.09 |
| **21** | 0 | 0 | 0 | NR | NR | NR | 0 | 0 | 0 | NR | NR | NR | T | NR | T | 0.02 | NR | 0.02 | 0.55 | 6 | 1.15 | 0.17 | 0.2 | 0.19 | 0 | 0 | 0 | 0.22 | NR | 0.22 | 0.33 | NR | 0.33 | 0 | 0 | 0 | 0 | 0 | 0 |
| **22** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NR | NR | NR | 0 | 0 | 0 | T | NR | T | 0 | 0 | 0 | 0.08 | 0.7 | 0.15 | NR | NR | NR | 0 | 0 | 0 | 0 | 0 | 0 | 0.22 | NR | 0.22 | NR | NR | NR |
| **23** | 0.32 | NR | 0.32 | 0 | 0 | 0 | 0 | 0 | 0 | NR | NR | NR | 0.67 | NR | 0.67 | 0.07 | NR | 0.07 | NR | NR | NR | 0.09 | 0 | 0.09 | NR | NR | NR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | T | NR | T |
| **24** | 0.03 | NR | 0.03 | 0.17 | NR | 0.17 | NR | NR | NR | NR | NR | NR | NR | NR | NR | T | NR | T | T | NR | T | 0.35 | 0.3 | 0.38 | NR | NR | NR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.02 | NR | 0.02 |
| **25** | 0.11 | NR | 0.11 | 0 | 0 | 0 | NR | NR | NR | NR | NR | NR | NR | NR | NR | 0 | 0 | 0 | 0 | 0 | 0 | NR | NR | NR | NR | NR | NR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.41 | NR | 0.41 |
| **26** | 0 | NR | 0 | 0 | 0 | 0 | 0.64 | NR | 0.64 | 0.12 | NR | 0.12 | NR | NR | NR | NR | NR | NR | 0 | 0 | 0 | NR | NR | NR | NR | NR | NR | 0.03 | NR | 0.03 | 0 | 0 | 0 | 0 | 0 | 0 | 0.17 | NR | 0.17 |
| **27** | 0 | NR | 0 | 0 | 0 | 0 | 0.41 | NR | 0.41 | 0.32 | NR | 0.32 | NR | NR | NR | NR | NR | NR | 0.15 | NR | 0.15 | 0 | 0 | 0 | NR | NR | NR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.16 | NR | 0.16 |
| **28** | 0.31 | NR | 0.31 | 0 | 0 | 0 | 0.66 | NR | 0.66 | NR | NR | NR | NR | NR | NR | NR | NR | NR | 0 | NR | 0 | 0 | 0 | 0 | NR | NR | NR | NR | NR | NR | 0 | 0 | 0 | NR | NR | NR | 0 | 0 | 0 |
| **29** | 1.32 | NR | 1.32 | 0 | 0 | 0 | 0.27 | NR | 0.27 | NR | NR | NR | 0.23 | NR | 0.23 | T | NR | T | 0 | NR | 0 | 0.83 | 0 | 0.83 | NR | NR | NR | NR | NR | NR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **30** | T | NR | T | 0 | 0 | 0 | 0.17 | NR | 0.17 | NR | NR | NR | 0 | 0 | 0 | 0.06 | NR | 0.06 | T | NR | T | | | | NR | NR | NR | NR | NR | NR | 0 | 0 | 0 | T | NR | T | 0 | 0 | 0 |
| **31** | 0 | 0 | 0 | 0.08 | NR | 0.08 | | | | 0.19 | NR | NR | | | | 0.16 | NR | 0.16 | 0 | 0 | 0 | | | | NR | NR | NR | NR | NR | NR | T | 0 | T | NR | NR | NR | 0.38 | NR | 0.38 |
| **Total** | 6.43 | 0 | 6.43 | 1.32 | 0 | 1.32 | 3.43 | 0 | 3.43 | 2.35 | 0 | 2.16 | 2.00 | 0 | 2.00 | 1.98 | 1.5 | 2.13 | 1.52 | 17.2 | 3.24 | 2.28 | 7.5 | 3.03 | 0.8 | 3.5 | 1.15 | 0.92 | 0 | 0.92 | 1.8 | 0 | 1.8 | 1.98 | 0 | 1.98 | 3.5 | 0 | 3.5 |
| **Avg.** | 0.27 | 0.00 | 0.27 | 0.07 | 0.00 | 0.07 | 0.15 | 0.00 | 0.15 | 0.11 | 0.00 | 0.11 | 0.09 | 0.00 | 0.09 | 0.10 | 0.17 | 0.11 | 0.06 | 0.82 | 0.13 | 0.12 | 0.47 | 0.16 | 0.04 | 0.29 | 0.06 | 0.04 | 0.00 | 0.04 | 0.09 | 0.00 | 0.09 | 0.07 | 0.00 | 0.07 | 0.19 | 0.00 | 0.19 |

Notes:
Data was recorded by NOAA Station Chesterton 1.4.
NR - No data recorded
T - Trace value recorded by NOAA
* Total precipitation values assume 10" of snow equals 1" of precipitation.

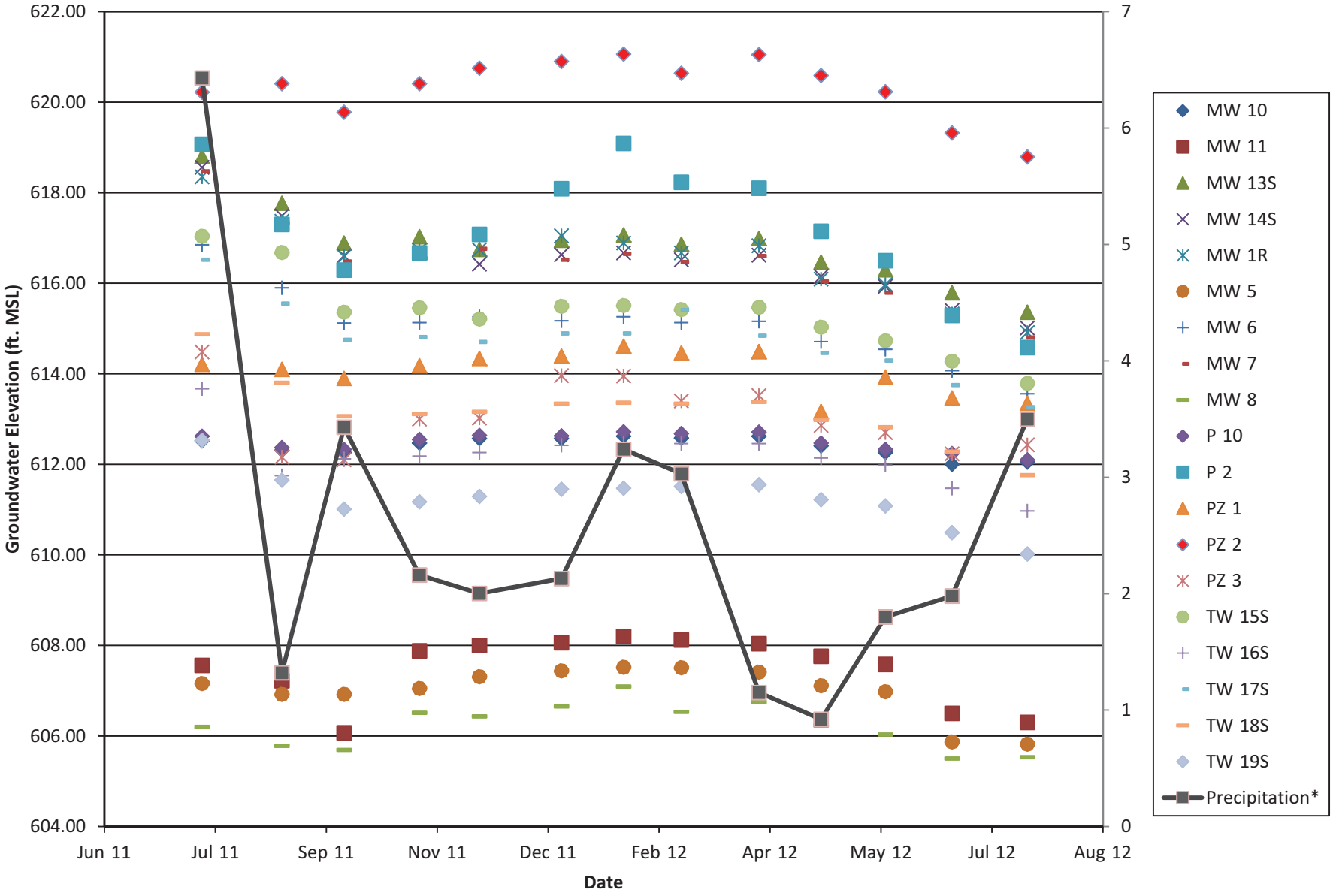
# Graphs

# Graph 1 Monthly Precipitation in North Central Indiana



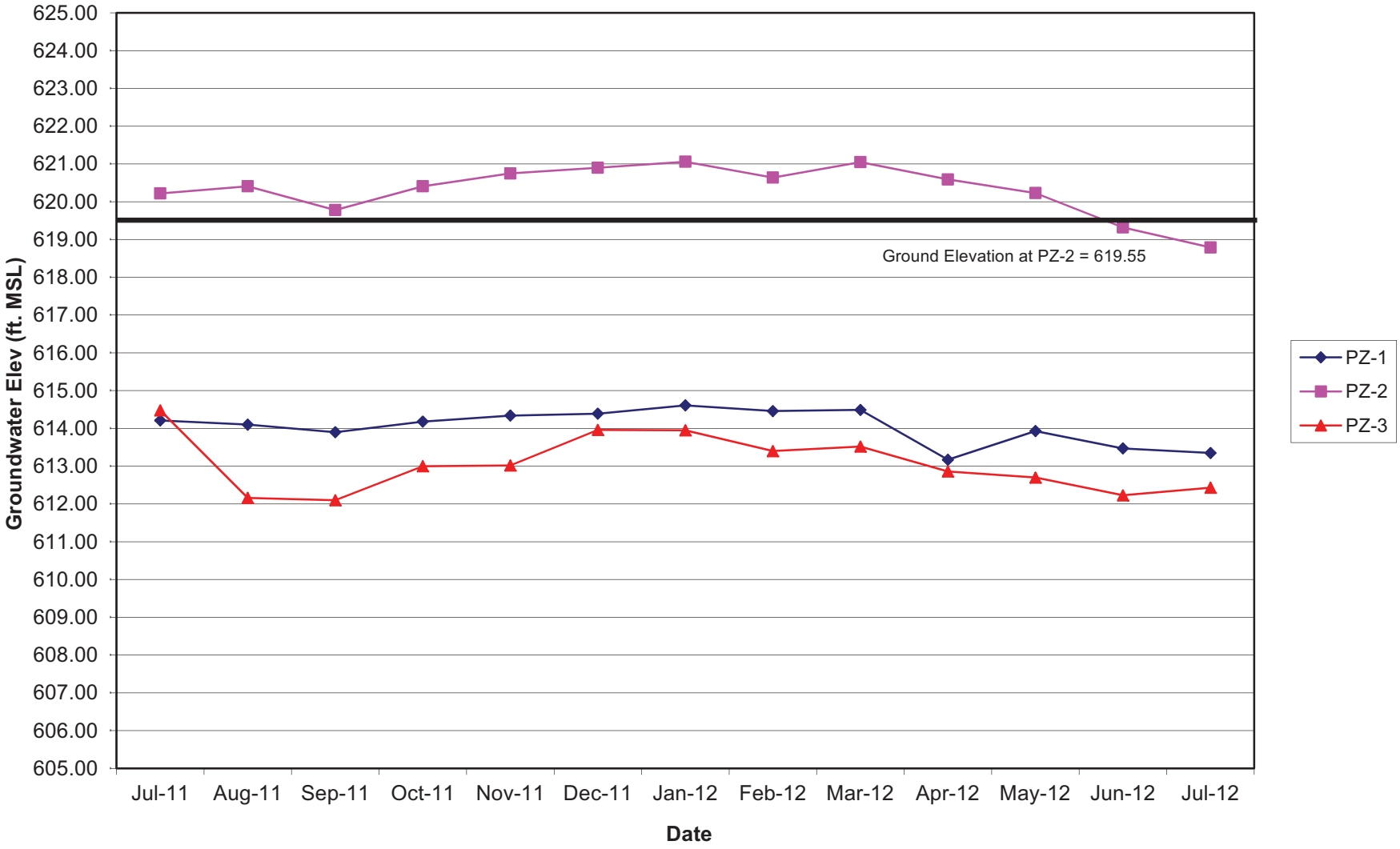

*Precipitation data collected from NOAA Station Chesterton, IN 1.4 ENE

# Graph 2 Groundwater Elevation and Monthly Precipitation at Yard 520

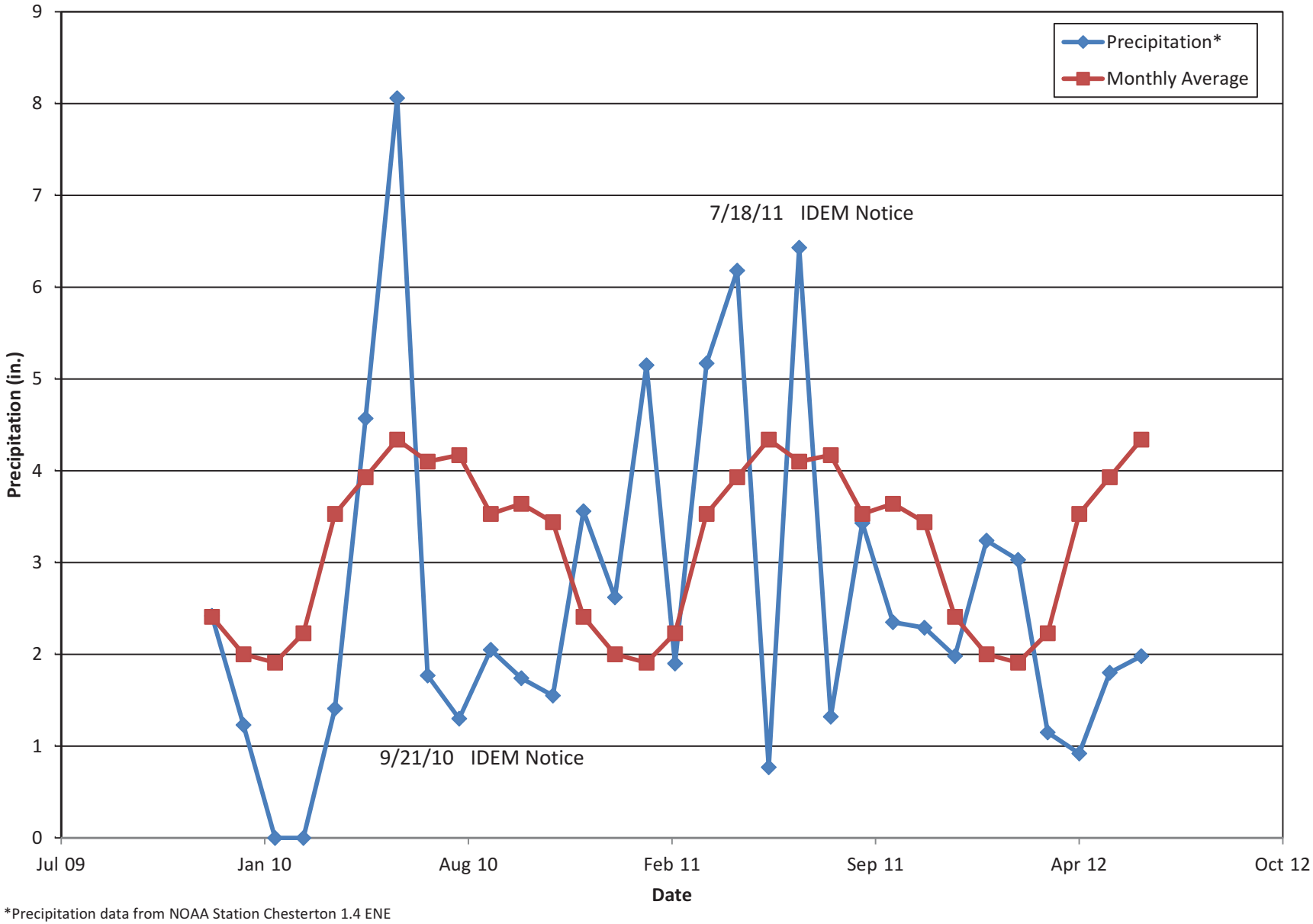



*Precipitation Data from NOAA Station Chesterton 1.4 ENE

## Graph 3 - Groundwater Elevation of New Piezometers Over Time

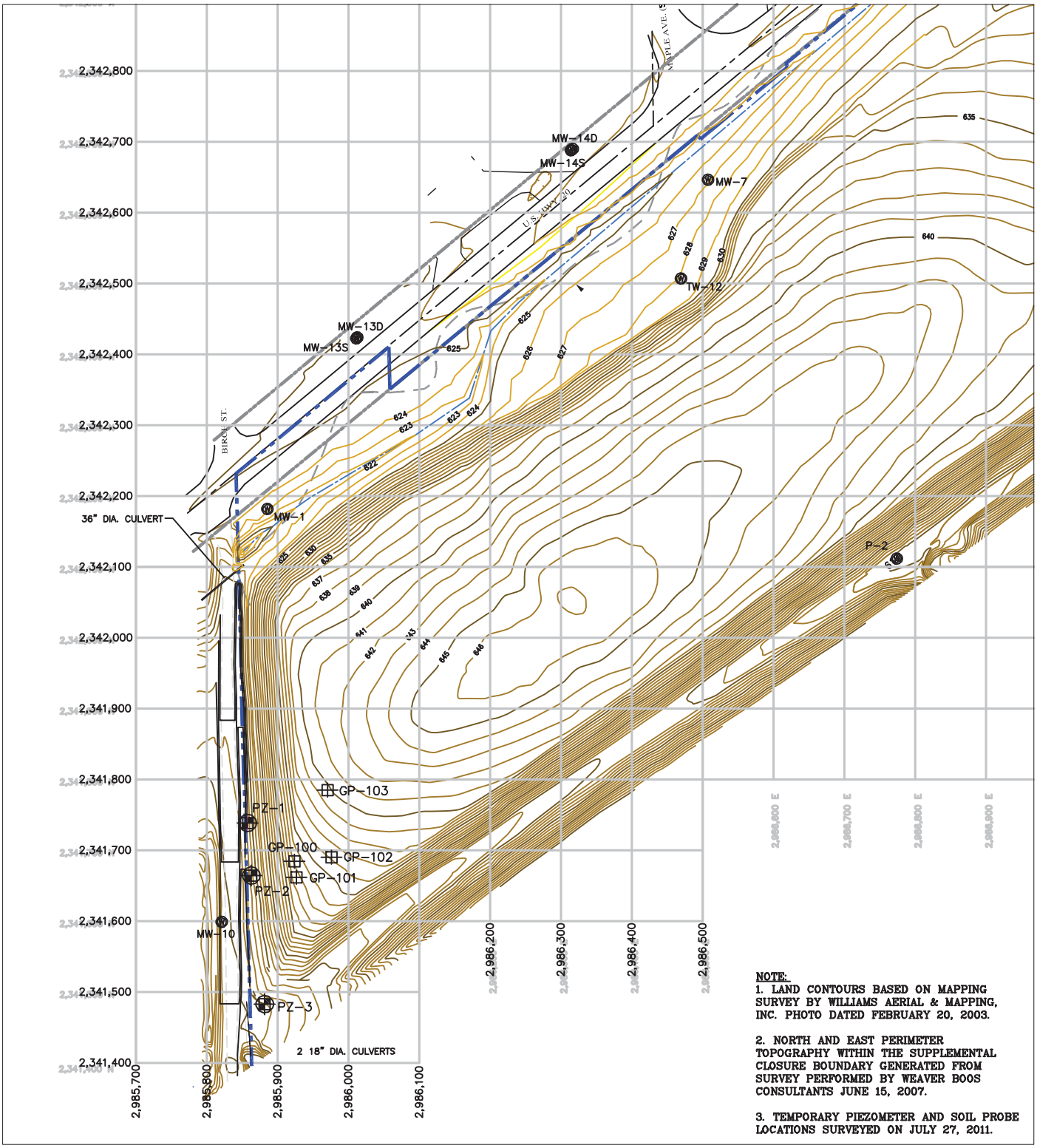


# Graph 4 Extended Monthly Precipitation Data




*Precipitation data from NOAA Station Chesterton 1.4 ENE

# Figures




NOTE:
1. LAND CONTOURS BASED ON MAPPING SURVEY BY WILLIAMS AERIAL & MAPPING, INC. PHOTO DATED FEBRUARY 20, 2003.

2. NORTH AND EAST PERIMETER TOPOGRAPHY WITHIN THE SUPPLEMENTAL CLOSURE BOUNDARY GENERATED FROM SURVEY PERFORMED BY WEAVER BOOS CONSULTANTS JUNE 15, 2007.

3. TEMPORARY PIEZOMETER AND SOIL PROBE LOCATIONS SURVEYED ON JULY 27, 2011.

**LEGEND**

PZ-1 ⊕ TEMPORARY PIEZOMETER LOCATION
GP-102 ⊞ CAP ASSESSMENT SOIL PROBE
P-2 Ⓦ EXISTING MONITORING WELL OR PIEZOMETER LOCATION

APPROXIMATE SCALE

0' 100' 200' 400'

N

# TEMPORARY PIEZOMETER AND SOIL PROBE LOCATIONS
YARD 520 RWS-TYPE II
PORTER COUNTY, INDIANA

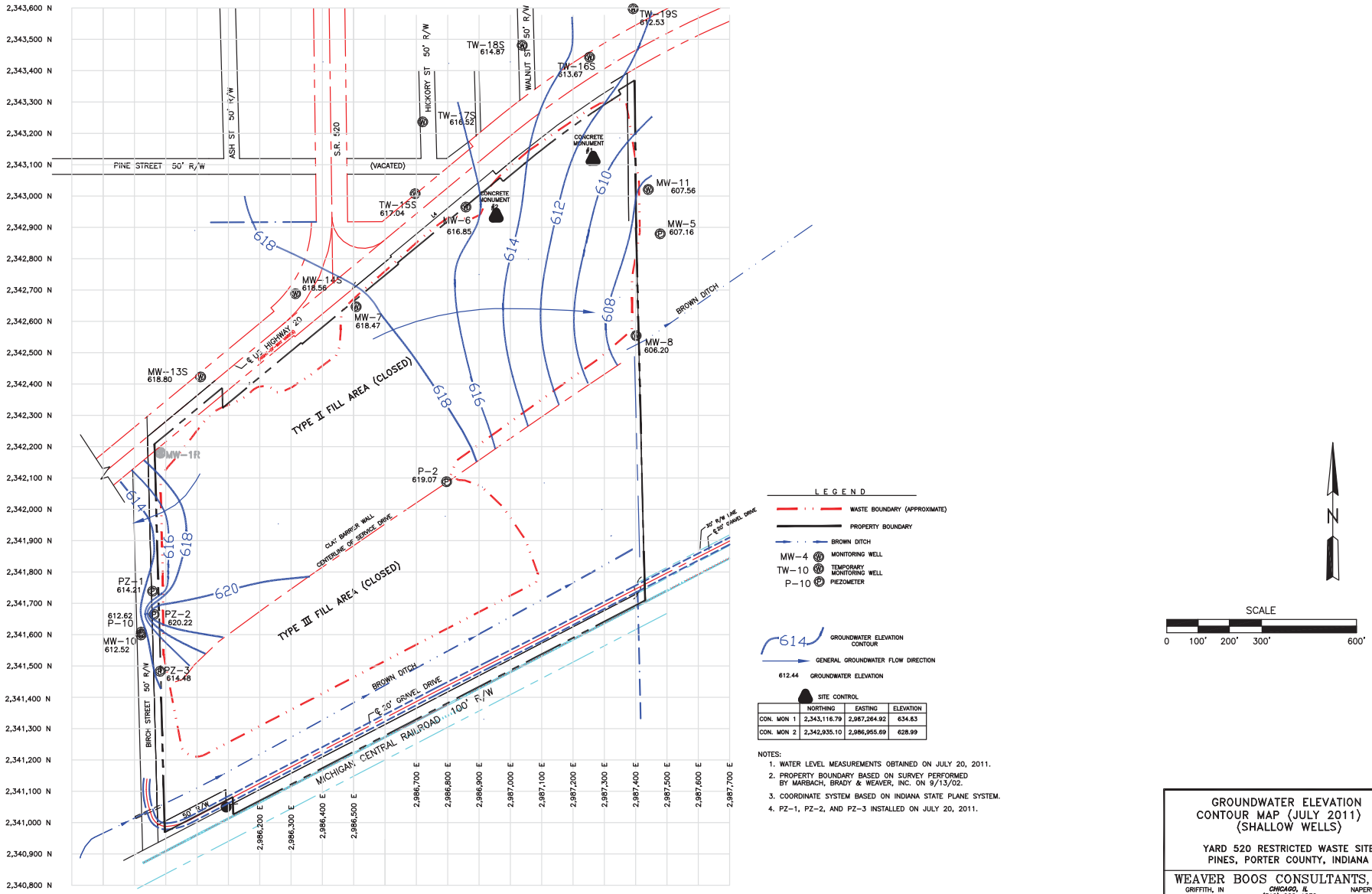

WEAVER BOOS CONSULTANTS

CHICAGO, IL
(312)922-1030

NAPERVILLE, IL
SPRINGFIELD, IL
COLUMBUS, OH
DENVER, CO

GRIFFITH, IN
SOUTH BEND, IN
FORT WORTH, TX
ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: RMD | DATE: 8/06/2012 | FILE:0013-01-01 |
| REVIEWED BY:MM | CAD:BI0000157.DWG | FIGURE 1 |




| | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.63 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

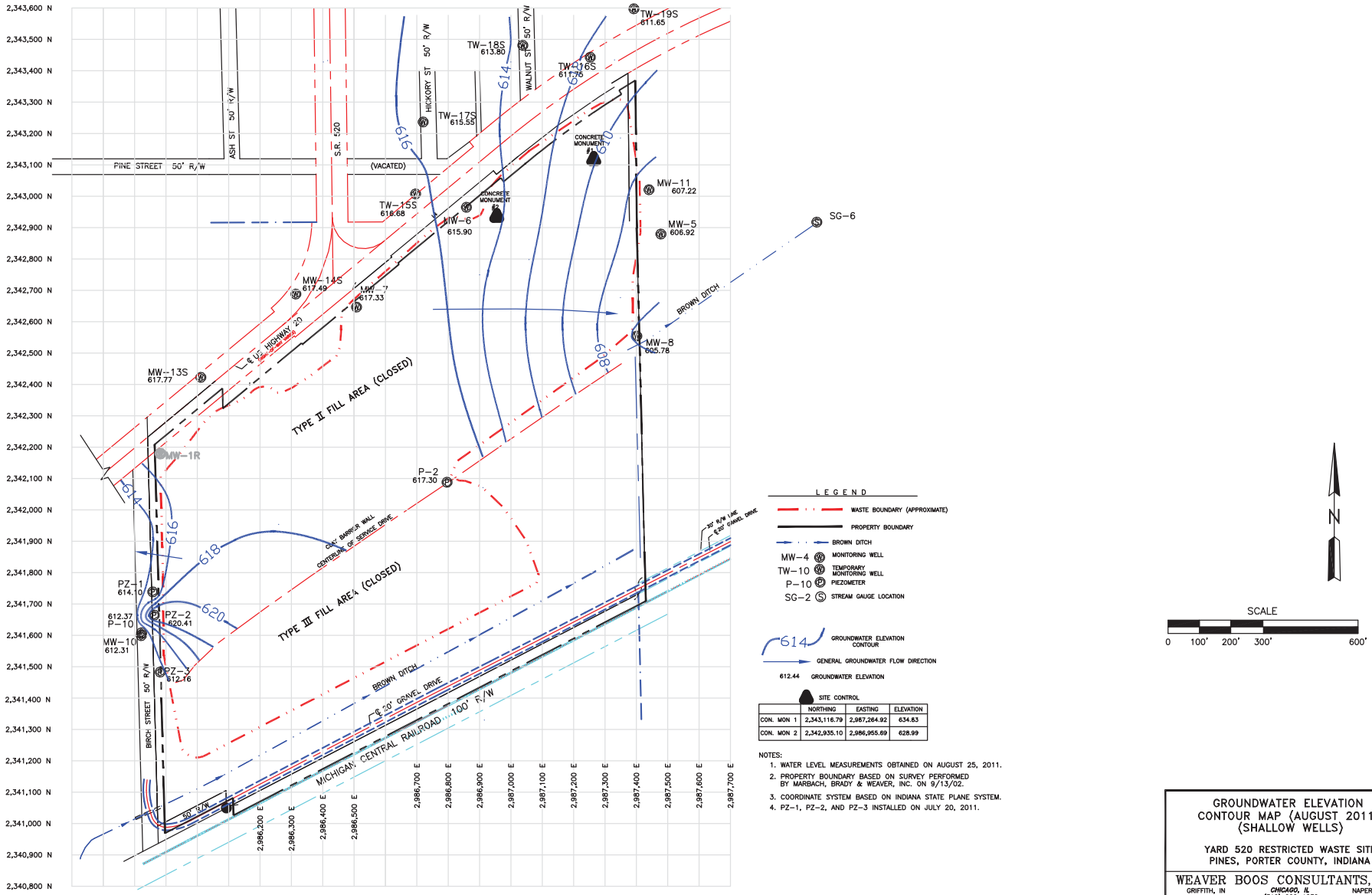
1. WATER LEVEL MEASUREMENTS OBTAINED ON JULY 20, 2011.
2. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
3. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
4. PZ-1, PZ-2, AND PZ-3 INSTALLED ON JULY 20, 2011.

# GROUNDWATER ELEVATION CONTOUR MAP (JULY 2011) (SHALLOW WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN · FORT WORTH, TX · COLUMBUS, OH
CHICAGO, IL (312) 922-1030 · SOUTH BEND, IN
NAPERVILLE, IL · SPRINGFIELD, IL · ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: TG | DATE: 09/19/2011 | FILE: 0013-01-01 |
| REVIEWED BY: PG | CAD: 0711SEEP.DWG | FIGURE 2 |




| | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.63 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

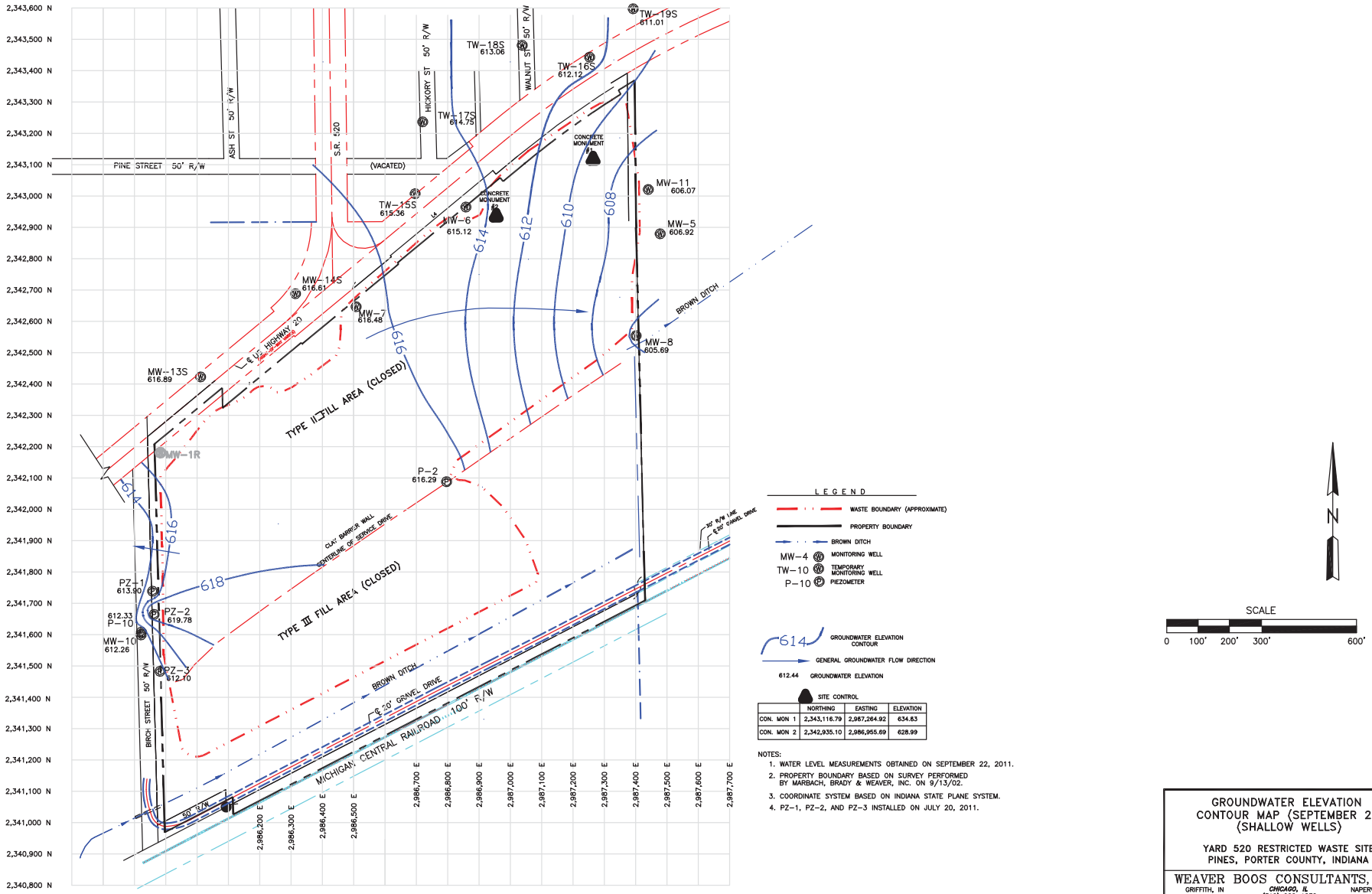
1. WATER LEVEL MEASUREMENTS OBTAINED ON AUGUST 25, 2011.
2. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
3. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
4. PZ-1, PZ-2, AND PZ-3 INSTALLED ON JULY 20, 2011.

# GROUNDWATER ELEVATION CONTOUR MAP (AUGUST 2011) (SHALLOW WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN · FORT WORTH, TX · COLUMBUS, OH
CHICAGO, IL (312) 922-1030 · SOUTH BEND, IN
NAPERVILLE, IL · SPRINGFIELD, IL · ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: TG | DATE: 09/19/2011 | FILE: 0013-01-01 |
| REVIEWED BY: JF | CAD: 0811SEEP.DWG | FIGURE 3 |




| | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.63 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

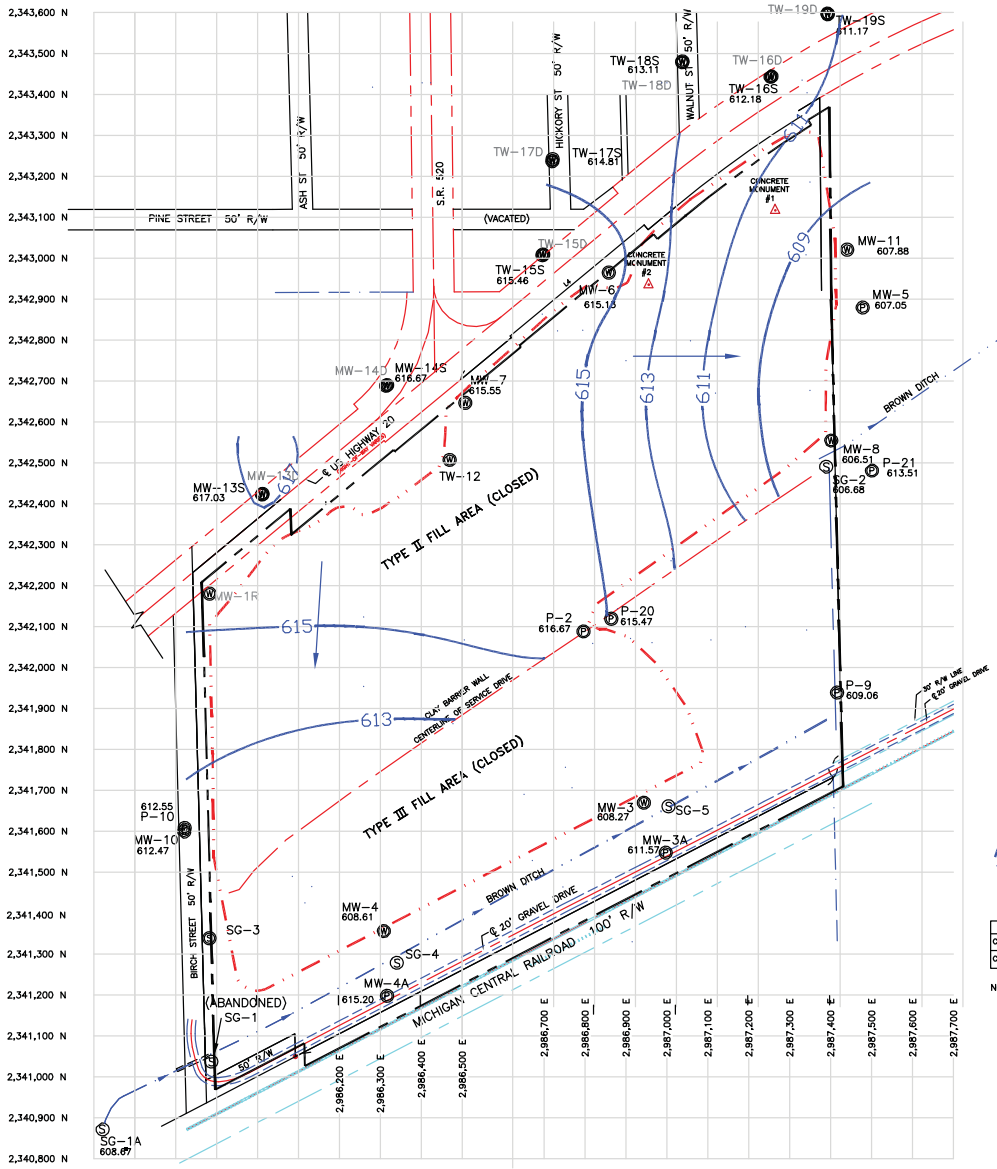
1. WATER LEVEL MEASUREMENTS OBTAINED ON SEPTEMBER 22, 2011.
2. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
3. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
4. PZ-1, PZ-2, AND PZ-3 INSTALLED ON JULY 20, 2011.

# GROUNDWATER ELEVATION CONTOUR MAP (SEPTEMBER 2011) (SHALLOW WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN
FORT WORTH, TX
COLUMBUS, OH
CHICAGO, IL
(312) 922-1030
SOUTH BEND, IN
NAPERVILLE, IL
SPRINGFIELD, IL
ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: TG | DATE: 09/19/2011 | FILE: 0013-01-01 |
| REVIEWED BY: PG | CAD: 0911SEEP.DWG | FIGURE 4 |




| Well ID | Groundwater Elevation | Ground Surface Elevation | Date of Measurement | Time | Well Type |
|---|---|---|---|---|---|
| *Monitoring Wells / Piezometers* | | | | | |
| P-2 | 616.67 | 619.66 | 10/26/11 | 831 | Piezometer |
| MW-3 | 608.27 | 616.00 | 10/26/11 | 835 | Trenwell |
| MW-3A | 611.57 | 620.90 | 10/26/11 | 835 | Piezometer |
| MW-4 | 608.61 | 619.10 | 10/26/11 | 840 | Trenwell |
| MW-4A | 615.20 | 621.20 | 10/26/11 | 840 | Piezometer |
| MW-5 | 607.05 | 608.90 | 10/26/11 | 910 | Piezometer |
| MW-6 | 615.13 | 628.87 | 10/26/11 | 912 | Upgradient |
| MW-7 | 616.55 | 624.90 | 10/26/11 | 940 | Upgradient |
| MW-8 | 606.51 | 612.40 | 10/26/11 | 828 | Downgradient |
| P-9 | 609.06 | 617.60 | 10/26/11 | 838 | Piezometer |
| P-10 | 612.55 | 614.50 | 10/26/11 | 842 | Piezometer |
| MW-10 | 612.47 | 614.50 | 10/26/11 | 850 | Temporary |
| MW-11 | 607.88 | 609.60 | 10/26/11 | 945 | Upgradient |
| MW-13S | 617.03 | 625.50 | 10/26/11 | 853 | Upgradient |
| MW-14S | 616.67 | 626.10 | 10/26/11 | 904 | Temporary |
| TW-15S | 615.46 | 628.00 | 10/26/11 | 908 | Temporary |
| TW-16S | 612.18 | 630.00 | 10/26/11 | 928 | Temporary |
| TW-17S | 614.81 | 631.90 | 10/26/11 | 935 | Temporary |
| TW-18S | 613.11 | 634.80 | 10/26/11 | 940 | Temporary |
| TW-19S | 611.17 | 630.30 | 10/26/11 | 943 | Temporary |
| P-20 | 615.47 | 618.91 | 10/26/11 | 832 | Piezometer |
| P-21 | 613.51 | 621.88 | 10/26/11 | 832 | Piezometer |
| *Stream Gauges* | | | | | |
| SG-1A | 608.67 | N/A | 10/26/11 | 950 | Surface Water |
| SG-2 | 606.68 | N/A | 10/26/11 | 1005 | Surface Water |
| SG-3 | NA | N/A | N/A | 1015 | Surface Water |
| SG-5 | NA | N/A | N/A | -- | Surface Water |
| SG-6 | 604.67 | N/A | 10/26/11 | -- | Surface Water |

NA: Not Available (Gauge underwater)

LEGEND

- WASTE BOUNDARY (APPROXIMATE)
- PROPERTY BOUNDARY
- BROWN DITCH
- MW-4 (W) MONITORING WELL
- TW-10 (W) TEMPORARY MONITORING WELL
- P-10 (P) PIEZOMETER
- SG-2 (S) STREAM GAUGE LOCATION
- 614 GROUNDWATER ELEVATION CONTOUR
- GENERAL GROUNDWATER FLOW DIRECTION
- 612.44 GROUNDWATER ELEVATION
- SITE CONTROL

| | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.83 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

N

SCALE
0 100' 200' 300' 600'

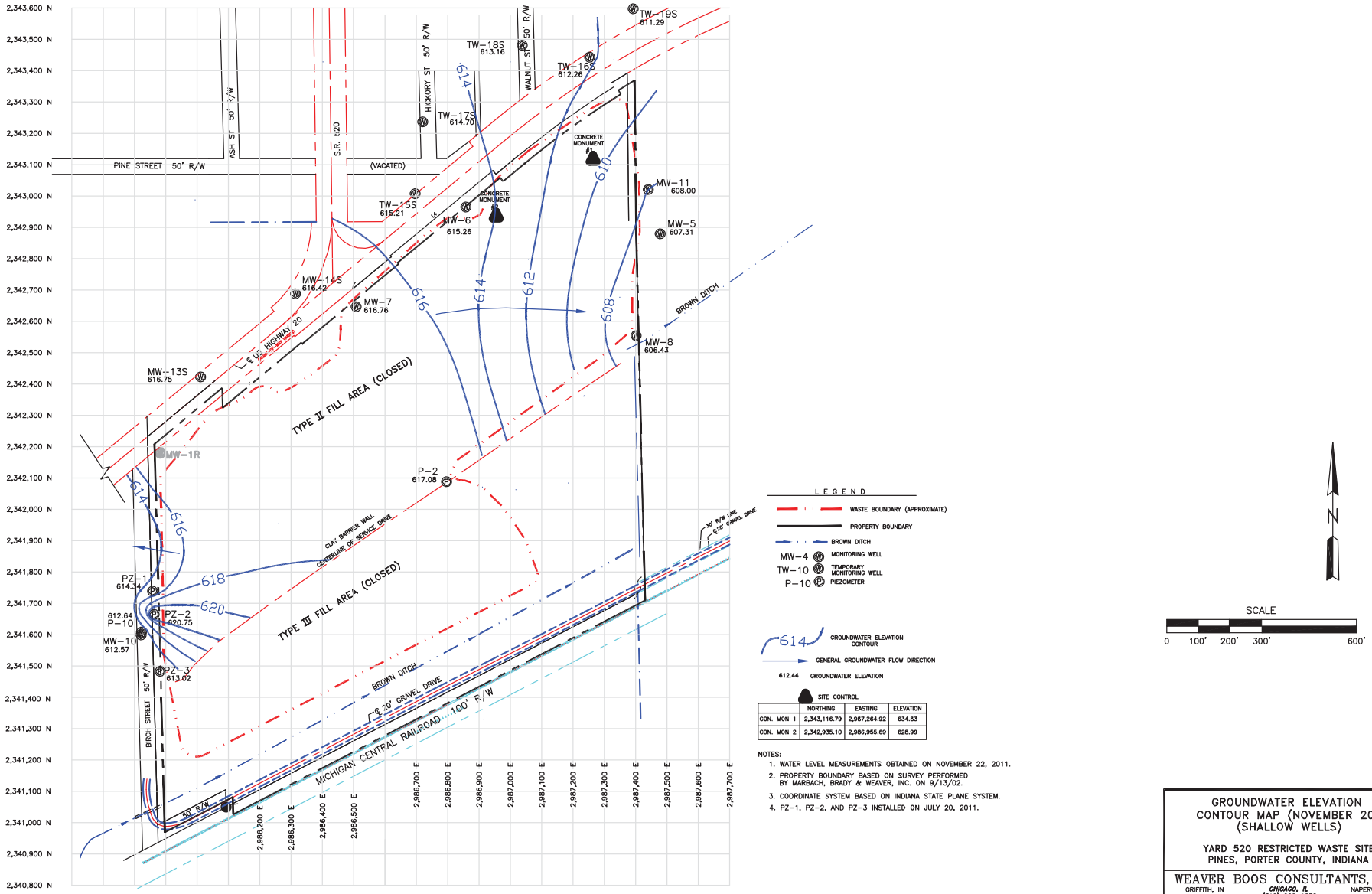
NOTES:
1. WATER LEVEL MEASUREMENTS OBTAINED ON OCTOBER 26, 2011.
2. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
3. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
4. STREAM GAUGE SG-1 WAS REMOVED FROM THE NETWORK IN JANUARY 2003 AND REPLACED WITH SG-1A.
5. SURVEY COORDINATES FOR SG-1A, SG-2 AND SG-5 WERE NOT AVAILABLE WHEN PREPARING THIS MAP. THEREFORE, THE LOCATIONS OF SG-1A, SG-2 AND SG-5 ARE APPROXIMATE.
6. P-2 INSTALLED APRIL 24, 2007, REPLACING DAMAGED PIEZOMETER MW-2.

# GROUNDWATER ELEVATION CONTOUR MAP (OCTOBER 2011) (SHALLOW WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN · FORT WORTH, TX · COLUMBUS, OH · CHICAGO, IL (312) 922-1030 · SOUTH BEND, IN · NAPERVILLE, IL · SPRINGFIELD, IL · ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: TG | DATE: 12/14/2011 | FILE: 0013-01-01 |
| REVIEWED BY: JF | CAD: 411-1.DWG | FIGURE 5 |




| | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.63 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

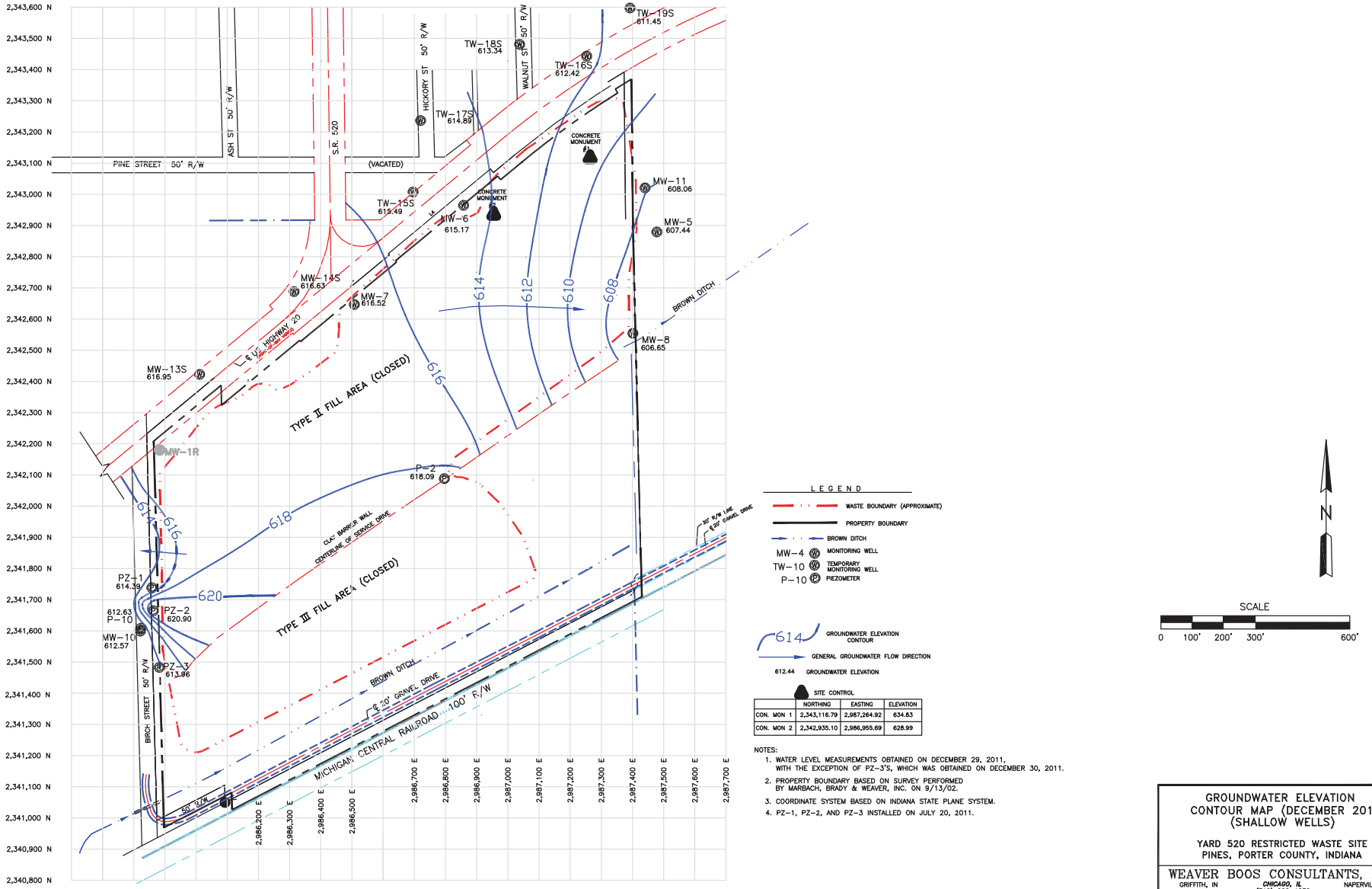
1. WATER LEVEL MEASUREMENTS OBTAINED ON NOVEMBER 22, 2011.
2. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
3. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
4. PZ-1, PZ-2, AND PZ-3 INSTALLED ON JULY 20, 2011.

# GROUNDWATER ELEVATION CONTOUR MAP (NOVEMBER 2011) (SHALLOW WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN
FORT WORTH, TX
COLUMBUS, OH
CHICAGO, IL
(312) 922-1030
SOUTH BEND, IN
NAPERVILLE, IL
SPRINGFIELD, IL
ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: TG | DATE: 1/20/2012 | FILE: 0013-01-01 |
| REVIEWED BY: MM | CAD: 1111.DWG | FIGURE 6 |




| | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.63 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

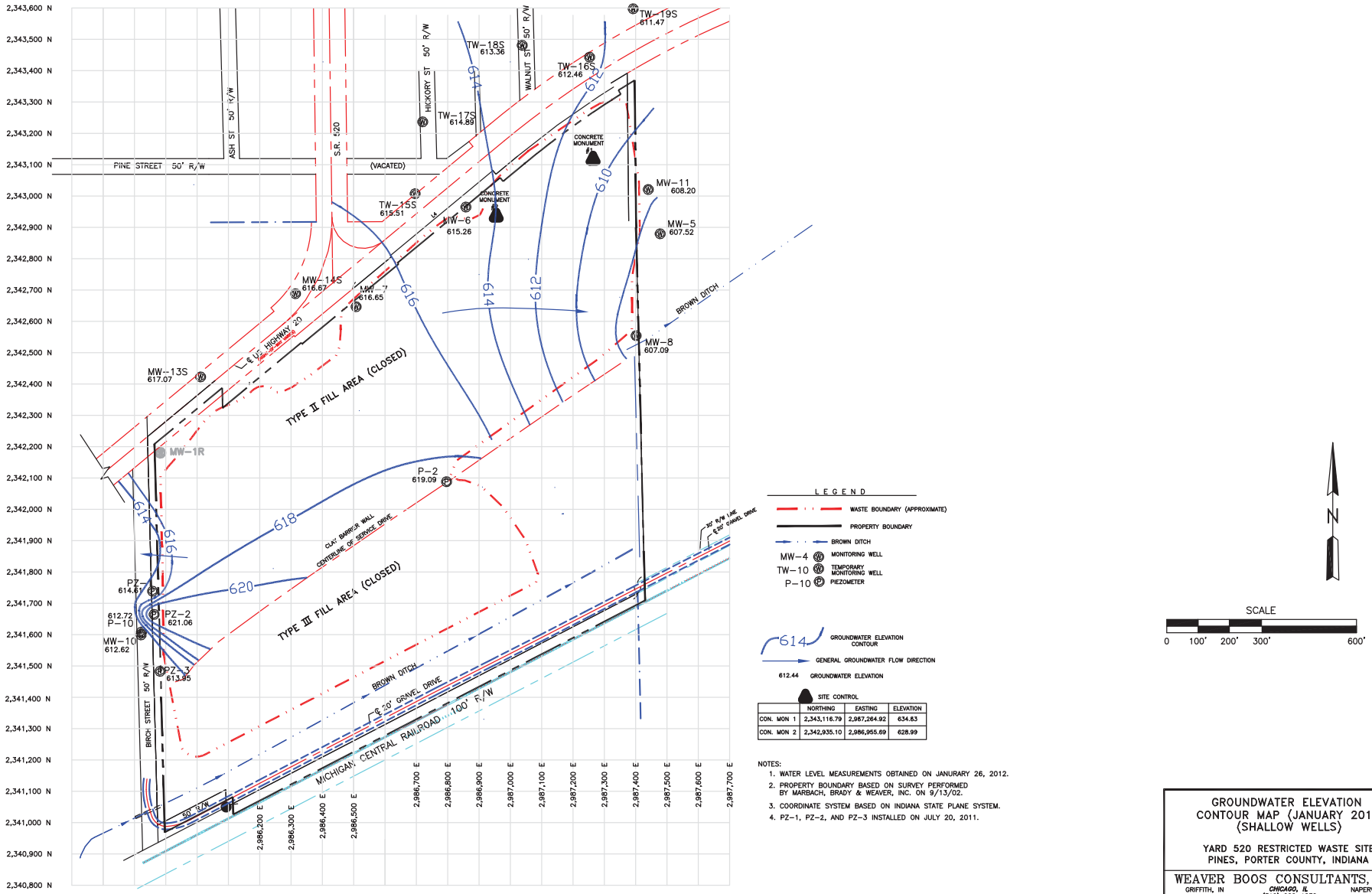
1. WATER LEVEL MEASUREMENTS OBTAINED ON DECEMBER 29, 2011, WITH THE EXCEPTION OF PZ-3'S, WHICH WAS OBTAINED ON DECEMBER 30, 2011.
2. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
3. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
4. PZ-1, PZ-2, AND PZ-3 INSTALLED ON JULY 20, 2011.

# GROUNDWATER ELEVATION CONTOUR MAP (DECEMBER 2011) (SHALLOW WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN · FORT WORTH, TX · COLUMBUS, OH
CHICAGO, IL (312) 922-1030 · SOUTH BEND, IN
NAPERVILLE, IL · SPRINGFIELD, IL · ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: TG | DATE: 1/20/2012 | FILE: 0013-01-01 |
| REVIEWED BY: MM | CAD: 1211.DWG | FIGURE 7 |




LEGEND

- WASTE BOUNDARY (APPROXIMATE)
- PROPERTY BOUNDARY
- BROWN DITCH
- MW-4 MONITORING WELL
- TW-10 TEMPORARY MONITORING WELL
- P-10 PIEZOMETER
- 614 GROUNDWATER ELEVATION CONTOUR
- GENERAL GROUNDWATER FLOW DIRECTION
- 612.44 GROUNDWATER ELEVATION
- SITE CONTROL

| | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.63 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

1. WATER LEVEL MEASUREMENTS OBTAINED ON JANURARY 26, 2012.
2. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
3. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
4. PZ-1, PZ-2, AND PZ-3 INSTALLED ON JULY 20, 2011.

N

SCALE

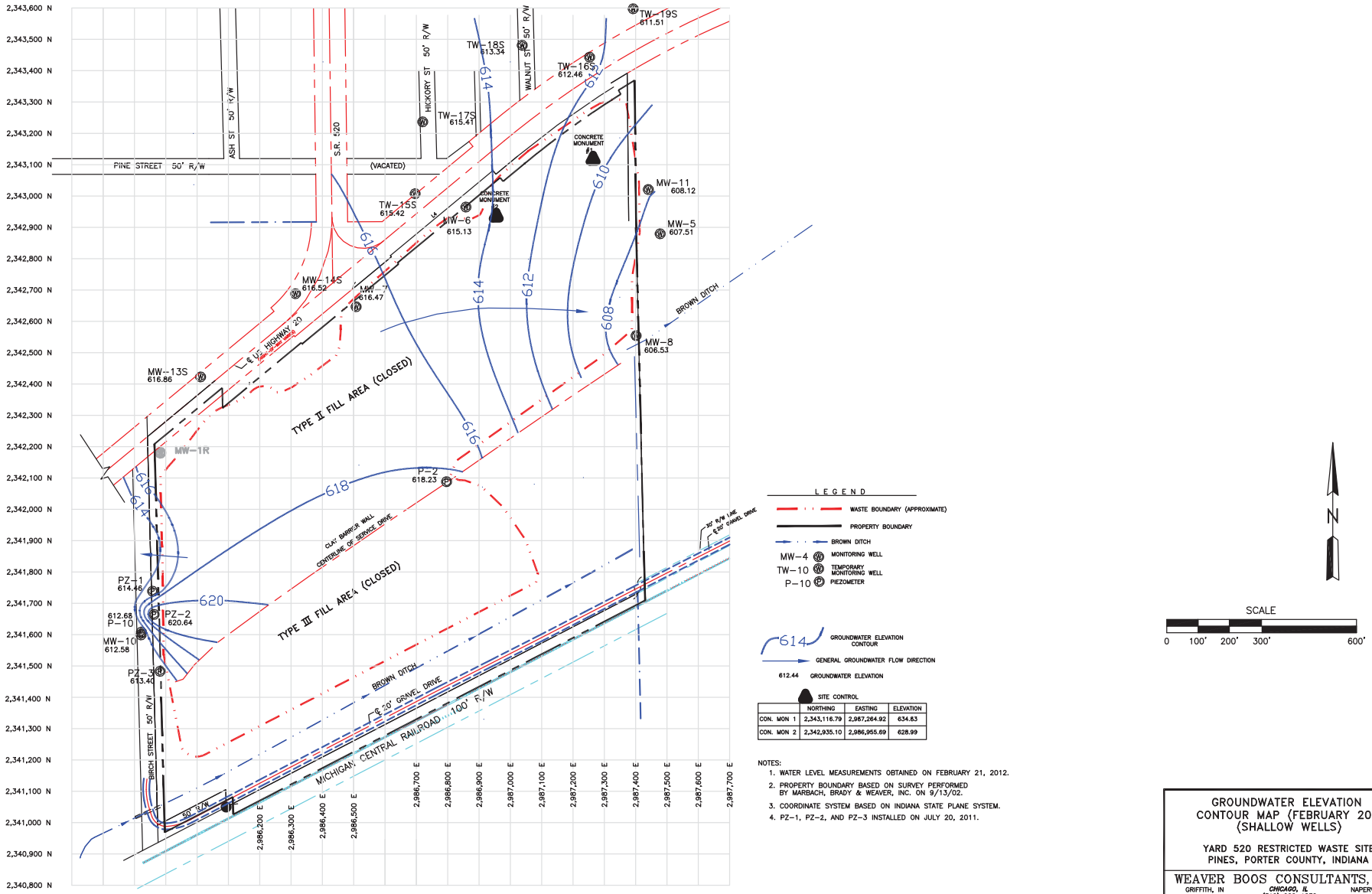
0 100' 200' 300' 600'

# GROUNDWATER ELEVATION CONTOUR MAP (JANUARY 2012) (SHALLOW WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN · FORT WORTH, TX · COLUMBUS, OH
CHICAGO, IL (312) 922-1030 · SOUTH BEND, IN
NAPERVILLE, IL · SPRINGFIELD, IL · ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: TG | DATE: 1/20/2012 | FILE: 0013-01-01 |
| REVIEWED BY: MM | CAD: 0112.DWG | FIGURE 8 |




| | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.63 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

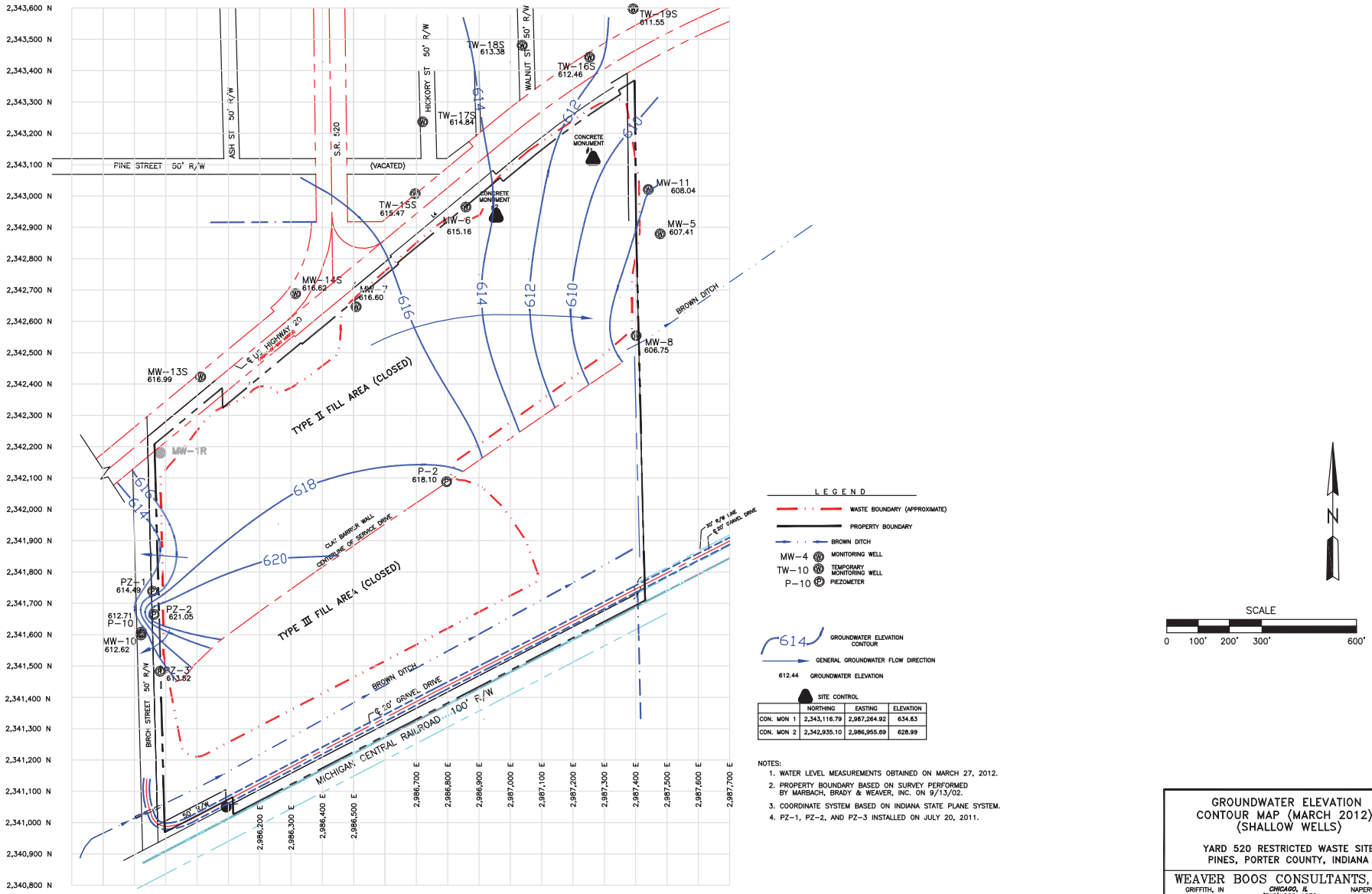
1. WATER LEVEL MEASUREMENTS OBTAINED ON FEBRUARY 21, 2012.
2. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
3. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
4. PZ-1, PZ-2, AND PZ-3 INSTALLED ON JULY 20, 2011.

# GROUNDWATER ELEVATION CONTOUR MAP (FEBRUARY 2012) (SHALLOW WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN
FORT WORTH, TX
COLUMBUS, OH
CHICAGO, IL
(312) 922-1030
SOUTH BEND, IN
NAPERVILLE, IL
SPRINGFIELD, IL
ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: TG | DATE: 2/20/2012 | FILE: 0013-01-01 |
| REVIEWED BY: MM | CAD: 0212.DWG | FIGURE 9 |




| | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.63 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

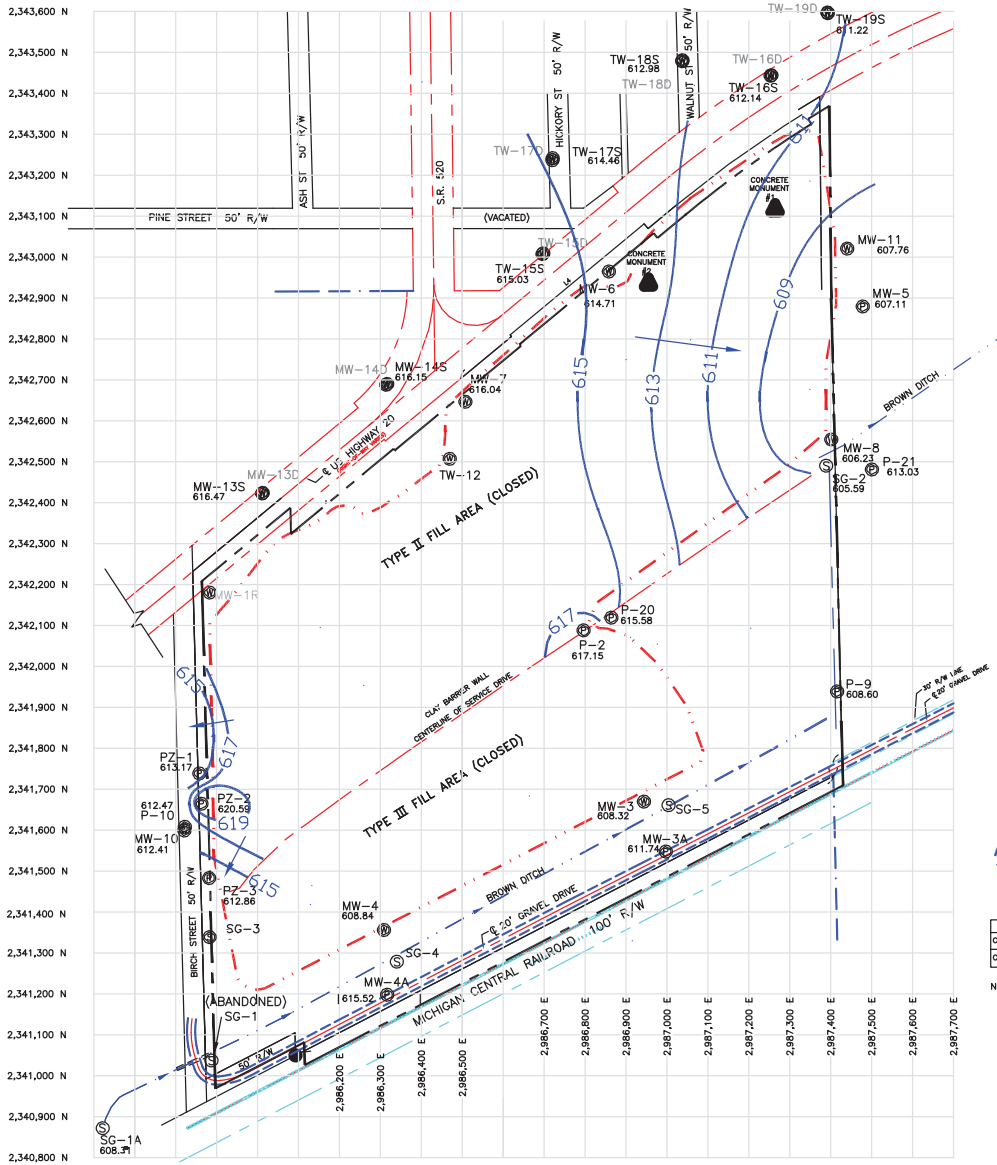
1. WATER LEVEL MEASUREMENTS OBTAINED ON MARCH 27, 2012.
2. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
3. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
4. PZ-1, PZ-2, AND PZ-3 INSTALLED ON JULY 20, 2011.

# GROUNDWATER ELEVATION CONTOUR MAP (MARCH 2012) (SHALLOW WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN · FORT WORTH, TX · COLUMBUS, OH
CHICAGO, IL (312) 922-1030 · SOUTH BEND, IN
NAPERVILLE, IL · SPRINGFIELD, IL · ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: TG | DATE: 6/12/2012 | FILE: 0013-01-01 |
| REVIEWED BY: MW | CAD: 0112.DWG | FIGURE 10 |




| Well ID | Groundwater Elevation | Ground Surface Elevation | Date of Measurement | Time | Well Type |
|---|---|---|---|---|---|
| *Monitoring Wells / Piezometers* | | | | | |
| P-2 | 617.15 | 619.66 | 4/23/12 | 831 | Piezometer |
| MW-3 | 608.32 | 616.00 | 4/23/12 | 835 | Intrawell |
| MW-3A | 611.74 | 620.90 | 4/23/12 | 835 | Piezometer |
| MW-4 | 608.84 | 619.10 | 4/23/12 | 840 | Intrawell |
| MW-4A | 615.52 | 621.20 | 4/23/12 | 840 | Piezometer |
| MW-5 | 607.11 | 608.90 | 4/23/12 | 910 | Piezometer |
| MW-6 | 614.71 | 628.87 | 4/23/12 | 912 | Upgradient |
| MW-7 | 616.04 | 624.90 | 4/23/12 | 940 | Upgradient |
| MW-8 | 606.23 | 612.40 | 4/23/12 | 828 | Downgradient |
| P-9 | 608.60 | 617.60 | 4/23/12 | 838 | Piezometer |
| P-10 | 612.47 | 614.50 | 4/23/12 | 842 | Piezometer |
| MW-10 | 612.41 | 614.50 | 4/23/12 | 850 | Temporary |
| MW-11 | 607.76 | 609.60 | 4/23/12 | 945 | Upgradient |
| MW-13S | 616.47 | 625.50 | 4/23/12 | 853 | Upgradient |
| MW-14S | 616.15 | 626.10 | 4/23/12 | 901 | Temporary |
| TW-15S | 615.03 | 628.00 | 4/23/12 | 908 | Temporary |
| TW-16S | 612.14 | 630.00 | 4/23/12 | 928 | Temporary |
| TW-17S | 614.46 | 631.90 | 4/23/12 | 935 | Temporary |
| TW-18S | 612.98 | 634.80 | 4/23/12 | 940 | Temporary |
| TW-19S | 611.22 | 630.50 | 4/23/12 | 943 | Temporary |
| P-20 | 615.58 | 618.91 | 4/23/12 | 832 | Piezometer |
| P-21 | 613.03 | 621.88 | 4/23/12 | 832 | Piezometer |
| Pz-1 | 613.17 | 617.93 | 4/23/12 | 826 | Piezometer |
| Pz-2 | 620.59 | 619.55 | 4/23/12 | 828 | Piezometer |
| Pz-3 | 612.86 | 617.86 | 4/23/12 | 830 | Piezometer |
| *Stream Gauges* | | | | | |
| SG-1A | 608.31 | N/A | 4/23/12 | 950 | Surface Water |
| SG-2 | 605.59 | N/A | 4/23/12 | 1005 | Surface Water |
| SG-3 | NA | N/A | N/A | 1015 | Surface Water |
| SG-5 | NA | N/A | N/A | -- | Surface Water |
| SG-6 | 604.31 | N/A | 4/23/12 | -- | Surface Water |

NA: Not Available (Gauge underwater)

LEGEND

- WASTE BOUNDARY (APPROXIMATE)
- PROPERTY BOUNDARY
- BROWN DITCH
- MW-4 MONITORING WELL
- TW-10 TEMPORARY MONITORING WELL
- P-10 PIEZOMETER
- SG-2 STREAM GAUGE LOCATION
- 614 GROUNDWATER ELEVATION CONTOUR
- GENERAL GROUNDWATER FLOW DIRECTION
- 612.44 GROUNDWATER ELEVATION
- SITE CONTROL

| | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.63 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

N

SCALE

0 100' 200' 300' 600'

NOTES:

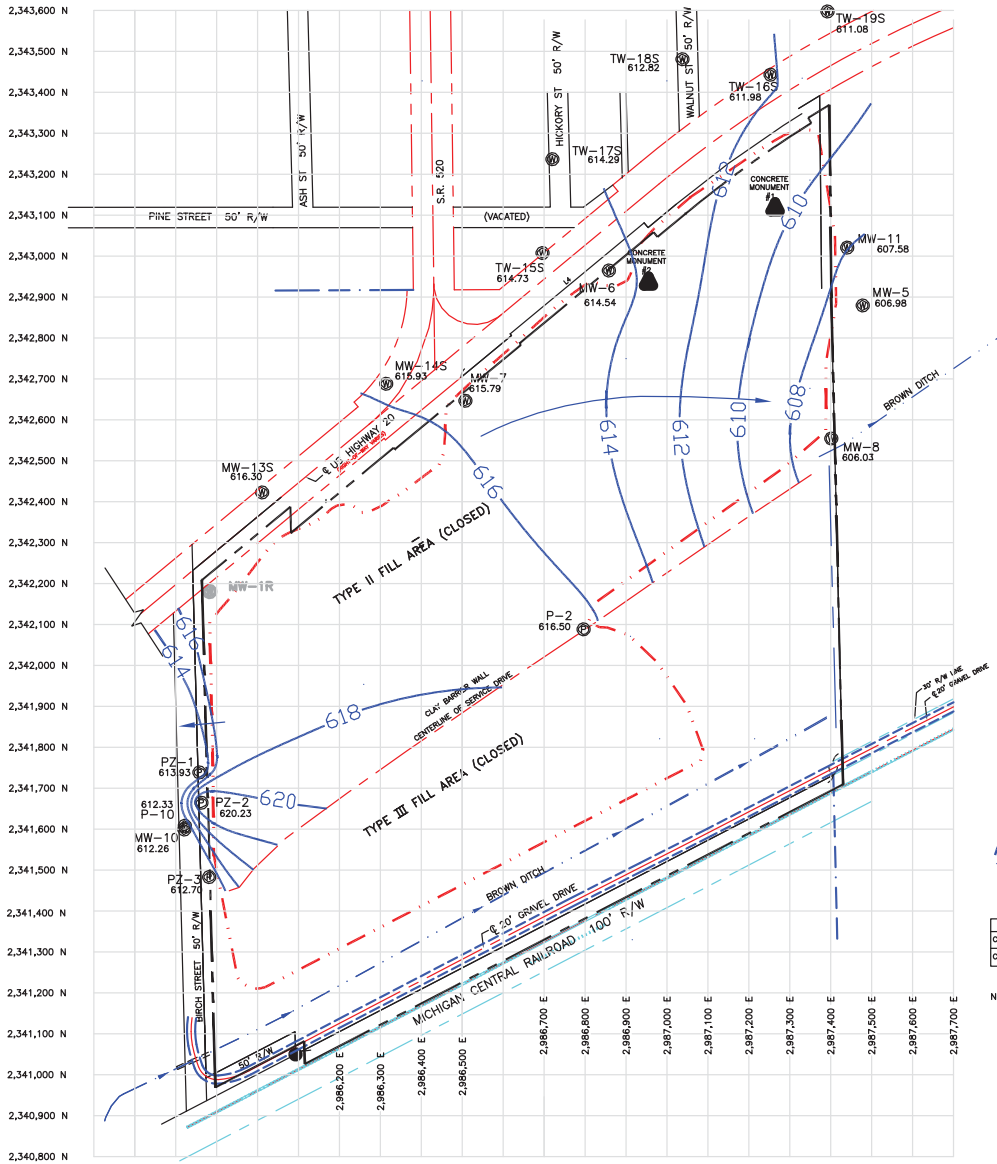
1. WATER LEVEL MEASUREMENTS OBTAINED ON APRIL 23, 2012.
2. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
3. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
4. STREAM GAUGE SG-1 WAS REMOVED FROM THE NETWORK IN JANUARY 2003 AND REPLACED WITH SG-1A.
5. SURVEY COORDINATES FOR SG-1A, SG-2 AND SG-5 WERE NOT AVAILABLE WHEN PREPARING THIS MAP. THEREFORE, THE LOCATIONS OF SG-1A, SG-2 AND SG-5 ARE APPROXIMATE.
6. P-2 INSTALLED APRIL 24, 2007, REPLACING DAMAGED PIEZOMETER MW-2.
7. PZ-1, PZ-2, AND PZ-3 INSTALLED JULY 20, 2011.

# GROUNDWATER ELEVATION CONTOUR MAP (APRIL 2012) (SHALLOW WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN
FORT WORTH, TX
COLUMBUS, OH
CHICAGO, IL
(312) 922-1030
SOUTH BEND, IN
NAPERVILLE, IL
SPRINGFIELD, IL
ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: TG | DATE: 5/17/2012 | FILE: 0013-01-14 |
| REVIEWED BY: MW | CAD: 411-1.DWG | FIGURE 11 |




LEGEND

- WASTE BOUNDARY (APPROXIMATE)
- PROPERTY BOUNDARY
- BROWN DITCH
- MW-4 MONITORING WELL
- TW-10 TEMPORARY MONITORING WELL
- P-10 PIEZOMETER
- 614 GROUNDWATER ELEVATION CONTOUR
- GENERAL GROUNDWATER FLOW DIRECTION
- 612.44 GROUNDWATER ELEVATION
- SITE CONTROL

| | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.63 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

1. WATER LEVEL MEASUREMENTS OBTAINED ON MAY 23, 2012.
2. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
3. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
4. PZ-1, PZ-2, AND PZ-3 INSTALLED ON JULY 20, 2011.

N

SCALE

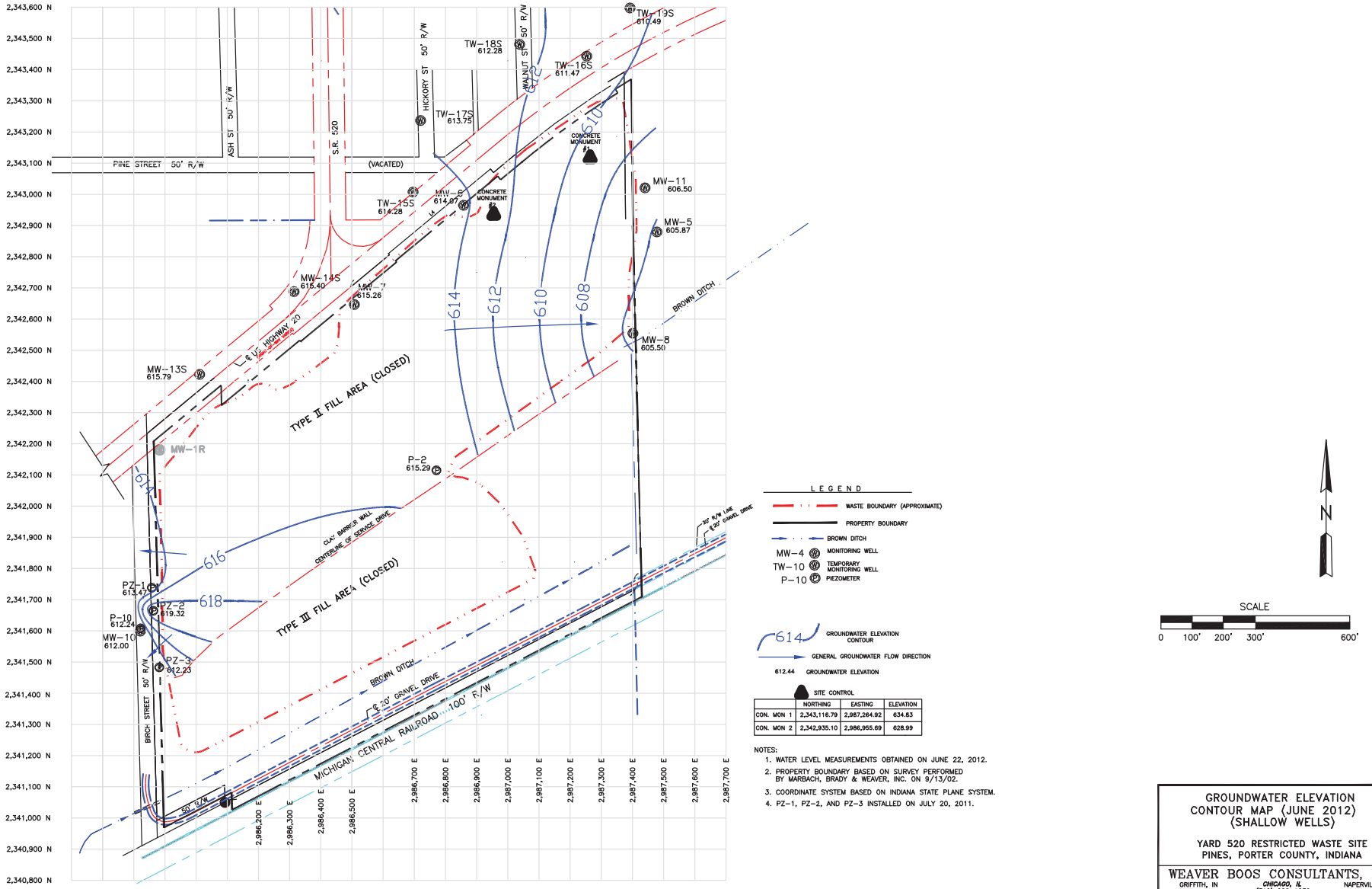
0 100' 200' 300' 600'

# GROUNDWATER ELEVATION CONTOUR MAP (MAY 2012) (SHALLOW WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN
FORT WORTH, TX
COLUMBUS, OH
CHICAGO, IL
(312) 922-1030
SOUTH BEND, IN
NAPERVILLE, IL
SPRINGFIELD, IL
ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: TG | DATE: 5/24/2012 | FILE: 0013-01-01 |
| REVIEWED BY: MM | CAD: 0512.DWG | FIGURE 12 |




| | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.63 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

1. WATER LEVEL MEASUREMENTS OBTAINED ON JUNE 22, 2012.
2. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
3. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
4. PZ-1, PZ-2, AND PZ-3 INSTALLED ON JULY 20, 2011.

# GROUNDWATER ELEVATION CONTOUR MAP (JUNE 2012) (SHALLOW WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN
FORT WORTH, TX
COLUMBUS, OH
CHICAGO, IL
(312) 922-1030
SOUTH BEND, IN
NAPERVILLE, IL
SPRINGFIELD, IL
ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: RMD | DATE: 7/6/2012 | FILE: 0013-01-01 |
| REVIEWED BY: MM | CAD: 0612.DWG | FIGURE 13 |

# Appendix B

# IDEM LETTER TO SITE

YFC

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
*We Protect Hoosiers and Our Environment.*

*Michael R. Pence*
Governor

*Thomas W. Easterly*
Commissioner

100 North Senate Avenue
Indianapolis, Indiana 46204
(317) 232-8603
Toll Free (800) 451-6027
www.idem.IN.gov

April 2, 2013

Yard 520 RWS II
Attn: Ms. Valerie Blumenfeld
1665 North 6500 East
Michigan City, Indiana 46360

Dear Ms. Blumenfeld:

Re: Site Assessment Report Update
Yard 520 RWS II
FP 64-04/64-07
Porter County

We have reviewed the Site Assesment Report (SAR) dated January 28, 2013 (VFC #67365931) for the Yard 520 Restricted Waste Site Type II (RWS II) landfill. You submitted the updated SAR in response to our conditional approval letter dated November 28, 2012 (VFC #67510033). Based on a review of your updated report, further clarification is needed.

According to the approval letter and the SAR, you plan to gather and evaluate additional ground water elevation measurements, gather precipitation data, and perform the specified additional action and repairs to the vegetative cover and cap over the next year. In addition, you agree to complete the supplemental work outlined in the approval, which includes incorporating an expanded boring program to determine cap thickness and integrity in the southwest corner of the RWS II landfill.

You provided additional data concerning the anomalously high ground water elevation at PZ-2 compared to surrounding piezometers. Ground water elevation graphs contained in the SAR show that the hydraulic head difference found between PZ-2 and surrounding piezometers is decreasing but remains anomalously high (4.5 to 5 feet higher than surrounding piezometers vs. the 6 feet noted in the Approval). The facility states that a higher topographic elevation (approximately 1.5 feet) and the presence of dense, brownish-grey clay unique to PZ-2 may be contributing a greater amount of pressure on the water table causing a difference in ground water elevations. We do not agree that the higher elevation and presence of the dense clay are causing the anomalously high ground water elevation at PZ-2. The cause of this anomaly remains unclear.

Therefore, the facility needs to provide additional data or propose an additional investigation plan to determine the source of the elevated ground water elevations at PZ-2. Possible causes may include, but are not limited to, the following: improper grouting/sealing of the well annulus; improper well construction or screened interval; or

a perched water table condition at this location. Please note that if it is determined that a perched water table condition exists at PZ-2, ground water elevation measurements from this source should not be used to develop future potentiometric maps.

Data from Graph 3 of the SAR shows that the ground water elevation at PZ-2 was above the ground surface elevation until May 2012 of the study period, which started in July 2011 and is ongoing. This hydraulic condition may relate to the historic seeps found in this area and may cause future seeps out of the landfill cap during normal precipitation events. Please note that the historic seeps found near the PZ-2 location resulted in multiple inspection summary/violation letters.

The site seems to have stabilized with lower ground water elevations and no seepage conditions present on the final cover. However, if excessive precipitation and/or elevated ground water elevations return with seepage outbreaks, IDEM may require the facility to remove and collect the seepage liquids or propose another engineering solution for control.

Public records for your facility are available in IDEM's Virtual File Cabinet (VFC) at www.IN.gov/idem.

If you have any questions, call (800) 451-6027, press 0, and ask for Alicia Brown or extension 2-8734, or call direct at (317) 232-8734.

Sincerely,

Summer Keown, Chief
Solid Waste Permits Section
Office of Land Quality

cc: Porter County Health Department
Porter County Commissioners
IDEM Northwest Regional Office
Recycling and Waste Reduction District of Porter County
Michael B. Maxwell, Weaver Boos Consultants North Central, LLC

# Appendix C

# OCTOBER 2012 YARD 520 MONITORING REPORT

**December 21, 2012**
**Project No.: 0013-01-01**

# OCTOBER 2012 GROUNDWATER MONITORING REPORT
# Yard 520 RWS
# Pines, Indiana

Prepared For:

**Yard 520 Restricted Waste Site**
**720 W. U.S. Highway 20**
**Michigan City, Indiana 46360**

Submitted to:

**Ms. Alicia Brown**
**Office of Land Quality**
**Indiana Department of Environmental Management**
**100 North Senate Avenue**
**Mail Code 65-45 IGCN 1101**
**Indianapolis, Indiana 46204**

**OCTOBER 2012 GROUNDWATER MONITORING REPORT**
**YARD 520 RWS**

## TABLE OF CONTENTS

# TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES

## TABLE OF CONTENTS

## LIST OF APPENDICES

# 1.0 INTRODUCTION

Weaver Boos Consultants North Central, LLC (Weaver Boos) has prepared the following groundwater monitoring report on behalf of the permittee for the sampling and analysis of monitoring wells at the Yard 520 Restricted Waste Site (RWS).

The Yard 520 RWS is located in Porter County, Indiana and is comprised of the following two areas separated by a clay barrier wall:

- Type II Area – North Area which has been certified as closed by the Indiana of Department of Environmental Management (IDEM) and is regulated under 329 IAC 10-31 and an Approval of Supplemental Closure/Post-Closure Plan correspondence from IDEM dated August 5, 2005; and
- Type III Area – South Area which was certified as closed by IDEM in a letter dated August 1, 2005. The Type III Area is regulated under IDEM Permit FP#64-07 dated September 3, 2003.

The following wells are currently included as part of the groundwater monitoring system:

| Monitoring Well Identification | Area Monitored |
|---|---|
| MW-1 | Type II |
| MW-3 | Type III |
| MW-4 | Type III |
| MW-6 | Type II |
| MW-7 | Type II |
| MW-8 | Type II |
| MW-10 | Type II |
| MW-11 | Type II |
| MW-13S | Type II |
| MW-13D | Type II |
| MW-14S | Type II |
| MW-14D | Type II |

The following temporary monitoring wells are also included in the monitoring network:

| | |
|---|---|
| TW-15S | TW-18S |
| TW-15D | TW-18D |
| TW-16S | TW-19S |
| TW-16D | TW-19D |
| TW-17S | TW-12 |
| TW-17D | |

The monitoring network details are summarized on **Table 1**.

Pursuant to a letter from IDEM dated April 5, 2004, which provided comments regarding the October 2003 Groundwater Monitoring Report, the above temporary monitoring wells (with the exception of TW-12) were analyzed for a limited list of parameters during the October 2012 semi-annual monitoring event. Specifically, the following parameters have been discontinued from the list of sampling parameters for the temporary wells (with the exception of TW-12):

- Cadmium (dissolved);
- Chromium (dissolved);
- Copper (dissolved);
- Mercury (dissolved);
- Selenium (dissolved);
- Silver (dissolved); and
- Zinc (dissolved).

IDEM had indicated in a letter dated March 14, 2005 that monitoring for the following constituents could be reduced to an annual basis for all temporary monitoring wells (with the exception of TW-12):

- Barium (dissolved);
- Cyanide;
- Fluoride; and
- Nitrate.

The report on the April 2011 monitoring event proposed that annual monitoring for the above list of constituents at temporary monitoring wells be discontinued. Weaver Boos identified that none of the above parameter concentrations have exceeded the groundwater protection standard

since 2001 at any of the temporary wells. Weaver Boos also indicated in the April 2011 report that the monitoring list at TW-12 would continue to include the current list of constituents. IDEM approved this modification to the sampling scope in an email to Weaver Boos dated September 30, 2011.

Included with this report are summary tables, statistical analyses, field sampling forms, groundwater elevation contour maps, constituent concentration maps, and analytical results of groundwater samples collected in October 2012 from the monitoring wells and surface water points.

## 2.0 PERMIT STATUS

Two separate permit renewals were issued on May 27, 1997: one for the Type II, North Area, and another for the Type III, South Area. The permit renewal approved the separation of the North and South Areas through construction of a minimum 10 foot recompacted clay barrier wall between the northern and southern portions of the facility. A permit renewal for the Type III South Area was issued by IDEM on September 3, 2003. The September 2003 renewal permit was issued to direct the closure and post-closure activities for the Type III Area. A letter from IDEM dated August 1, 2005 approved the Final Closure Certification for the Type III Area. According to this letter, the 30-year post-closure period for the Type III Area began on August 1, 2005.

The Type II Area has been certified as closed in accordance with a letter from IDEM dated July 27, 1998 and is regulated under 329 IAC 10-31 and Cause No. 89-S-J-271, Joint Stipulations, signed with IDEM in May 1995. Supplemental closure activities have been undertaken at the Type II Area in accordance with an Approval of Supplemental Closure/Post-Closure Plan correspondence from IDEM dated August 5, 2005. A Supplemental Closure Construction Certification Report was submitted to IDEM on behalf of the permittee on June 28, 2007. Pursuant to 329 IAC 10-30-7(b), with the passage of 150 days since submission of the report to IDEM and with no notice of deficiency having been issued by IDEM, the Closure Certification Report was deemed sufficient as of November 25, 2007. Therefore, the 10-year post-closure period for the Type II Area will end no earlier than November 25, 2017.

### 2.1 Groundwater/Surface Water Monitoring-Related Issues

As of the October 2012 semi-annual monitoring event, groundwater and surface water monitoring activities at the Yard 520 RWS were performed in accordance with the following:

- Activities at the Type II North Area are in accordance with a Corrective Action Program Proposal (CAPP) dated June 17, 2005. A review letter concerning the CAPP was prepared by IDEM and dated August 12, 2005. A copy of this letter is provided in **Appendix A2**. The CAPP references the Assessment Monitoring Program Plan (AMPP), submitted in August 2004 and approved by IDEM in a letter dated October 12, 2004. The statistical analysis of groundwater data from the Type II Area is discussed below in Section 2.1.1.

- Activities at the Type III South Area are in accordance with an AMPP last revised July 2003 and approved by IDEM in a letter dated August 19, 2003. The statistical analysis of groundwater and surface water data from the Type III Area is discussed below in Section 2.1.2.

### *2.1.1 Statistical Analysis (Type II Area)*

Based upon statistically significant increases observed in groundwater samples collected at the Type II Area wells during the October 2004 semi-annual groundwater monitoring event, Section 3.4.1 of the August 2004 AMPP indicates that a plan for a corrective action program was required within 180 days from the date of the October 2004 Groundwater Monitoring Report. A Corrective Action Program Proposal (CAPP) was submitted to IDEM on behalf of the permittee by Weaver Boos in a letter dated June 17, 2005. The CAPP indicated that the supplemental closure activities planned for specific areas along the boundaries of the Type II Area would serve as the corrective action. The CAPP indicated that future monitoring would be undertaken in accordance with the August 2004 AMPP for the Type II Area. IDEM provided a review letter for the June 17, 2005 CAPP dated August 12, 2005. The review letter indicated that various additional monitoring activities needed to be incorporated into the corrective action monitoring plan for the RWS II (see copy of August 12, 2005 letter provided in **Appendix A**). The October 2012 monitoring event was conducted in accordance with IDEM's August 12, 2005 letter.

The August 2004 AMPP for the Type II Area was approved with two modifications in a letter from IDEM dated October 12, 2004. One modification related to the Mann-Kendall trend evaluation. The modification stated that after every eight sampling events (four years), a Mann-Kendall evaluation must be conducted at each of the monitoring wells (i.e. the permitted monitoring wells) for (1) the most recent eight sampling events of data and (2) all the historical data for evaluation of short term and long term groundwater trends. This trend evaluation was last performed in April 2010 and therefore will not be due again until April 2014. The second modification indicated that in order to return to Phase I detection monitoring, the Phase II monitoring parameters must (1) over a one year period (two semi-annual monitoring events) demonstrate that no SSIs are present and (2) demonstrate the occurrence of a statistically significant downward trend.

The August 2004 AMPP specifies that evaluation of downgradient wells will include a comparison of analytical results to the applicable Groundwater Protection Standard (GWPS). Section 3.3 of the August 2004 AMPP lists the procedures implemented to establish the GWPS.

The GWPS was derived from the background prediction limits and the various regulatory levels. Results of the comparisons of the downgradient wells to the GWPS are included in this report in Section 5.1.1.

Groundwater data from the sidegradient wells associated with the Type II Area was also evaluated utilizing the GWPS. However the GWPS for the sidegradient wells is derived using procedures different than the downgradient wells. The GWPS was developed utilizing the results of Mann-Kendall trend evaluation and the various regulatory levels listed in **Table 4**. A description of the Mann-Kendall trend evaluation is included in Section 4.2.1 of the December 2003 Revised Statistical Evaluation Plan (StEP). A Mann-Kendall trend evaluation was conducted for each of the parameters that had a detection frequency greater than 50 percent. If a statistically significant upward trend was identified, the concentration was then compared to the most stringent of the regulatory levels in **Table 4,** followed by a comparison to the GWPS. Thus, an exceedance is considered to occur only if a statistically significant upward trend is present AND the existing concentrations exceed the most stringent regulatory level and/or GWPS listed in **Table 4**. Results of the comparisons of the sidegradient wells to the GWPS are discussed in this report in Section 5.1.1.

Trend testing conducted within this report includes data from the most recent eight sampling events pursuant to an email from IDEM dated July 31, 2012 in response to review of the April 2012 Semi-Annual Groundwater Monitoring Report dated June 19, 2012.

In accordance with Section 3.4.1 of the August 2004 AMPP, every two years a Mann-Kendall trend evaluation will be conducted for each parameter at each well (i.e., upgradient, downgradient, and sidegradient). As long as temporary wells are sampled, trend testing will also be performed every two years at the temporary monitoring wells, but only for the specific list of constituents being monitored at these wells (and only for constituents detected more frequently than 50% of the time). The trend evaluation is to include both long term trends (including all data) and short term trends (including only the 8 most recent sampling events). The most recent trend evaluation in accordance with the above requirement was performed within the groundwater monitoring report on the April 2012 sampling event. Therefore, the next bi-annual trend evaluation pursuant to the above requirements will need to be performed following the April 2014 sampling event.

### *2.1.2 Statistical Analysis (Type III Area)*

The revised AMPP for the Type III Area was submitted to IDEM in July 2003 to address IDEM comments on the February 2003 AMPP received in a letter dated May 5, 2003. The July 2003 AMPP was approved with two modifications in a letter from IDEM dated August 19, 2003. One modification related to the criteria for implementing corrective action related activities due to exceeding the groundwater and surface water protection standards as discussed in the AMPP. That criterion was modified from two (2) or more Phase II parameters to one (1) or more Phase II parameters. The second modification contained within IDEM's August 19, 2003 letter was that, after completing 8 sampling events, the facility must calculate the Mann-Kendall trend analyses for (1) the most recent 8 quarters of data, and (2) all the data in order to evaluate for short term and long term trends in the data. The results from this trend analysis for all the historical data was submitted to IDEM with the report on the April 2006 sampling event.

Within this report, Mann-Kendall trend analyses was conducted for Phase II parameters listed in the AMPP with a detection frequency greater than 50% for the most recent eight data points, in accordance with the email from IDEM dated July 31, 2012 referenced above. Mann-Kendall trend analyses for MW-3 and MW-4 is provided in **Appendix C1**. Data from each of the monitoring wells within the Type III Area have also been compared to the most stringent regulatory level as shown on **Table 5**.

Pursuant to the July 2003 AMPP, surface water data from the Type III Area was compared to the surface water protection standards (SWPS) listed on **Table 7**. The SWPS for each parameter is the greater of the established prediction limit and the Surface Water Quality Standard as provided in 327 IAC 2-1.5.

Additional surface water monitoring has been implemented in accordance with a scope included within a letter from Weaver Boos to IDEM dated October 11, 2004. IDEM approved the scope included within the October 11, 2004 letter, with modifications, in a letter dated November 10, 2004. In summary, four additional surface water monitoring points were added to the monitoring network for the Type III Area (SG-3, SG-4, SG-5, and SG-6). Pursuant to verbal communications between Weaver Boos and IDEM on January 21, 2005, the design of the staff gauges installed was similar to existing staff gauges SG-1A and SG-2. A calibrated metal strip was affixed to a steel I-beam and the I-beam was set as deep as possible into the subsurface soils using a backhoe. Additionally, as discussed during the January 21, 2005 conversation with IDEM, a staff gauge was not installed at location SG-4 due to difficulties associated with

mobilizing heavy equipment to this location, however, surface water samples are collected at the proposed SG-4 location.

## 3.0 GROUNDWATER FLOW CHARACTERISTICS

The groundwater flow direction and gradient are illustrated on groundwater elevation contour maps included as **Figures 1** and **2**. Two maps were prepared, one for shallow wells (screened at water table surface) and one for deeper wells (screened near the bottom of the uppermost aquifer). The following points were utilized to construct the shallow zone groundwater elevation contour map:

| | | |
|---|---|---|
| P-2 | MW-10 | TW-17S |
| MW-3 | P-10 | TW-18S |
| MW-4 | MW-11 | TW-19S |
| MW-6 | MW-13S | SG-1A |
| MW-7 | MW-14S | SG-2 |
| MW-8 | TW-15S | PZ-1 |
| P-9 | TW-16S | PZ-2 |
| PZ-3 | | |

The following points were utilized to construct the deeper zone groundwater elevation contour map:

| | | |
|---|---|---|
| MW-1R | P-10 | TW-15D |
| P-2 | MW-11 | TW-16D |
| MW-6 | TW-12 | TW-17D |
| MW-8 | MW-13D | TW-18D |
| MW-10 | MW-14D | TW-19D |

Some wells are utilized to generate groundwater contour maps for both the shallow and deep zones. These wells are located in an area where the uppermost aquifer thins and the entire saturated thickness of the uppermost aquifer is monitored. This includes MW-10, P-10, MW-8, and MW-11. Also, P-2 and MW-6 are screened at approximately the midpoint of the aquifer monitored. Therefore, these wells are also included on both the shallow and deep zone maps consistent with previous communications with IDEM.

In general, the groundwater flow direction in the shallow portion of the uppermost aquifer is east-southeast beneath the eastern portion of the Type II North Area and generally south-southwest beneath the western portion of the Type II North Area. The groundwater flow direction in the deeper portion of the uppermost aquifer is generally to the east-southeast over the eastern portion of the Type II North Area and generally to the south-southwest over the central and western portions of the Type II North Area.

The surface water flow pattern appears generally consistent with past data. The surface water elevation is higher at upstream location SG-1A and lower surface water elevations were observed at downstream locations SG-2 and SG-6. SG-6 continues to represent the farthest downstream location monitored (located at the downstream property boundary).

## 4.0 FIELD ACTIVITIES

The semi-annual groundwater sampling activities were conducted on October 22-24, 2012. Groundwater samples were analyzed for the Phase I parameters listed in Condition D9 of IDEM's August 5, 2005 Approval of Supplemental Closure/Post Closure Plan correspondence for the Type II Area (see **Table 2**). In addition, groundwater samples were analyzed for the supplemental parameters (see **Table 3**) pursuant to the AMPP dated July 2003 for the Type III Area and the AMPP dated August 2004 for the Type II Area. The Phase I and supplemental parameter list is collectively identified as the "Phase II parameter list". Groundwater samples at the temporary wells (except for TW-12) were analyzed for a limited list of parameters pursuant to previous letters from IDEM discussed above in Section 1. Based upon the Type II and Type III AMPPs, when metals analysis was required, samples were analyzed for dissolved metals only. Samples analyzed for dissolved metals were filtered in the field with a 0.45-micron filter.

Field sampling activities were implemented in accordance with the approved Groundwater Sampling and Analysis Plan (GWSAP) for the facility dated August 28, 1997 (revised September 29, 1998). Field duplicate samples were obtained from: MW-8, TW-14S, and SG-1A. Two field blanks and one equipment blank were also collected. The equipment blank was obtained from the peristaltic pump used for filtering the groundwater samples in the field after the decontamination process was performed. Field data sheets for the October 2012 monitoring event are provided as **Appendix B**. The laboratory analytical reports from the October 2012 semi-annual sampling event are included as **Appendix D**. In accordance with the Effective Permit Items D11 and F11 (for the Type II RWS and Type III RWS respectively), quality assurance/quality control data related to this sampling event will be retained and available upon request by IDEM, for a minimum of three years following the analyses. Digital submission of the analytical results for the October 2012 sampling event was also transmitted to IDEM through the e-mail address OLQDATA@IDEM.IN.GOV. The electronic data deliverable was formatted in accordance with IDEM Office Memorandum *Guidance for Digital Submittals for Ground-Water Data Solid Waste Land Disposal Facilities*, dated October 18, 1999.

# 5.0 GROUNDWATER ANALYTICAL RESULTS

## 5.1 Permitted Monitoring Wells

### *5.1.1 Type II Area*

Statistical comparisons for the upgradient and downgradient wells at Type II Area were made in accordance with Section 3.3.1 of the IDEM approved August 2004 AMPP. Concentrations have been compared to the GWPS as indicated in the August 2004 AMPP as shown on **Table 4**.

Concentrations of the following parameters were observed above (or below in the case of pH) the GWPS in upgradient (background) well(s):

- Boron (dissolved);
- Chloride;
- Iron (dissolved);
- Manganese (dissolved);
- pH (field);
- Sodium (dissolved);
- Specific Conductivity (field); and
- Total Dissolved Solids.

Concentrations of the following parameters were observed above (or below in the case of pH) the GWPS in at least one downgradient well:

- Arsenic (dissolved);
- Boron (dissolved);
- Iron (dissolved);
- pH (field);
- Potassium (dissolved);
- Sulfate (total); and
- Sulfide (total).

Downgradient monitoring wells MW-8 and MW-11 (located on the east side of the Type II Area) exhibited concentrations of boron (dis.), iron (dis.), and sulfate above the GWPS. Concentrations of arsenic (dis.) and potassium also exceeded the GWPS at MW-8. Groundwater at MW-8 and MW-11 ultimately discharges to Brown Ditch near SG-2 and SG-6. While concentrations of boron (dis.) and sulfate exceed the surface water protection standard (SWPS) at SG-2, concentrations are substantially reduced farther downstream at SG-6. Concentrations of boron (dis.) and sulfate are below the SWPS at SG-6. The concentrations of arsenic (dis.) and iron (dis.) are below the SWPS at both SG-2 and SG-6. Potassium (dis.) concentrations in surface water are greater than the SWPS at SG-2 and SG-6 and further discussion concerning potassium is presented below in Section 6.1.

In general, the above data indicates that the higher concentrations of these constituents found on the east side of the Type II Area downgradient of the fill area dissipate in a downgradient/downstream direction.

MW-10 (located on the southwest side of the Type II Area) exhibited concentrations of boron (dis.), pH, potassium, sulfate, and sulfide above the GWPS. Groundwater flow in this area of the facility is believed to be around the clay barrier wall to the south, ultimately discharging into the tributary to Brown Ditch located parallel to Birch Street, the wetland area to the west of Birch Street and/or Brown Ditch itself. Results from the surface water sampling at points downstream of this area (i.e., SG-4 and SG-5) for boron (dis.), pH, sulfate, and sulfide indicate that concentrations are below the SWPS. Concentrations of potassium in the surface water are discussed further in Section 6.1 below.

Similar to the conditions on the east side of the Type II Area, in general, this data suggests that the groundwater impacts on the west side of the Type II Area are limited in extent and do not extend a significant distance beyond the facility property boundary. Additionally, results from the trend testing on the most recent eight data points at MW-10 do not indicate any statistically significant upward trends, indicating that conditions appear to have stabilized.

The spatial distribution of the above constituents is shown on the constituent concentration contour maps included in the **Figures** section of this report. A similar number of parameters were observed at concentrations above the GWPS in upgradient wells, in comparison to the downgradient wells. This indicates that the upgradient groundwater quality is variable and is poor in quality with respect to certain constituents.

In accordance with Section 3.3.2 of the December 2003 StEP and the August 2004 AMPP, a trend analysis was performed for sidegradient wells MW-6 and MW-7. Pursuant to the July 31, 2012 email from IDEM, the Mann-Kendall trend analysis tests utilized the most recent eight data points. Trend testing was conducted for parameters exhibiting a detection frequency greater than 50 percent. Results from the trend testing are included in **Appendix C2**. Pursuant to Section 3.4.2 of the August 2004 AMPP, the GWPS was considered achieved unless a statistically significant upward trend was identified AND the current concentration for that constituent exceeds the most stringent regulatory standard/GWPS. The following statistically significant upward trends were identified at Type II sidegradient wells:

- Boron (dissolved) at MW-7;
- Fluoride at MW-7;
- Iron (dissolved) at MW-7;
- Molybdenum (dissolved) at MW-6; and
- Potassium (dissolved) at MW-7.

Parameters that indicated a statistically significant upward trend in Type II sidegradient wells were then compared to the most stringent value of the regulatory levels, followed by the GWPS (shown on **Table 4**). As described above, an exceedance is not noted unless the existing concentration exhibited a statistically significant upward trend AND exceeded the most stringent regulatory level and/or GWPS. In the cases of fluoride at MW-7 and potassium (dissolved) at MW-7, the current concentration is less than the most stringent regulatory level and/or the GWPS. As a result, no exceedance was noted for these parameters.

However, concentrations of boron (dissolved) at MW-7, iron (dissolved) at MW-7, and molybdenum (dissolved) at MW-6, exhibited a statistically significant upward trend and the current concentration exceeded the most stringent regulatory level/GWPS.

As a follow-up step to these findings, an evaluation of the monitoring network in the vicinity of MW-6 and MW-7 and points downgradient was performed. According to the groundwater elevation contour maps provided as **Figures 1** and **2**, groundwater from MW-6 and MW-7 ultimately discharges to Brown Ditch near SG-2 and SG-6. Of the above constituents, only boron (dissolved) exhibited concentrations above the surface water protection standard (SWPS) at the downstream monitoring points. Although downstream surface water sampling location SG-2 exhibited boron (dissolved) concentrations greater than the surface water protection

standard, the boron (dissolved) concentrations were substantially reduced at SG-6 and were in fact, below the SWPS at SG-6.

Therefore, water samples representative of water leaving the site and at the compliance point meet applicable water quality criteria. Further, the installation of final cover and a drainage ditch within the area extending from the toe of the slope to US Highway 20 during the supplemental closure activities has minimized surface water infiltration in the area of MW-6 and MW-7. The groundwater quality and trends at wells located within the supplemental closure site will continue to be monitored on a regular basis.

In accordance with Item 8 in Sections 3.4.1 and 3.4.2 of the August 2004 AMPP, we are herein providing IDEM with notification that secondary standards have been identified in sidegradient or downgradient wells at concentrations exceeding two times the Secondary Maximum Contaminant Level (SMCL):

- Iron (dissolved);
- Manganese (dissolved);
- Sulfate; and
- Total Dissolved Solids.

Pursuant to IDEM's July 31, 2012 email, short term trend testing was also conducted for the upgradient and downgradient Type II wells. Results are included in **Appendix C2**. The trend test results are summarized below.

The following statistically significant upward trends were identified at upgradient/downgradient wells:

- Barium (dissolved) at MW-13S (upgradient);
- Boron (dissolved) at, MW-11, MW-13S (upgradient), MW-14S (upgradient), and MW-14D (upgradient);
- Chloride at MW-8;
- Manganese (dissolved) at MW-1R (upgradient), MW-13S (upgradient), and MW-14D (upgradient);
- Potassium (dissolved) MW-13S (upgradient);
- Sulfate at MW-14D (upgradient); and

- Total Dissolved Solids (TDS) at MW-11.

The following statistically significant downward trends were identified at upgradient/downgradient wells:

- Iron (dissolved) at MW-10
- Manganese (dissolved) at MW-11
- pH (field) at MW-13S (upgradient); and
- Sodium (dissolved) at MW-14D (upgradient).

The trend testing results from the upgradient/downgradient wells exhibited a significant number of statistically significant upward trend in upgradient wells, which suggests that the background groundwater is potentially being influenced by external factors unrelated to the Yard 520 facility.

In accordance with the July 2005 CAPP and August 2005 IDEM Review Letter, the next semi-annual groundwater monitoring event at the Type II Area will be performed in April 2013.

*5.1.2 Type III Area*

The July 2003 AMPP for the Type III Area states that trend analysis will be the primary mechanism used to evaluate groundwater data. The last eight data points available at MW-3 and MW-4 were used to conduct the trend analysis pursuant to IDEM's July 31, 2012 email. The AMPP also states that data exhibiting a statistically significant upward trend will be compared to various regulatory levels. Statistical comparisons for the Type III Area were made in accordance with Section 3.3.1 of the approved AMPP revised July 8, 2003. Data obtained during the October 2012 semi-annual groundwater sampling event was compared to various regulatory levels as shown on **Table 5**.

Concentrations of the following parameters were observed above regulatory levels at MW-3 and/or MW-4:

- Arsenic (dissolved);
- Boron (dissolved);
- Manganese (dissolved) (MW-3 only);
- Molybdenum (dissolved);
- Sulfate (total) (MW-3 only); and

- Total Dissolved Solids (MW-3 only).

The spatial distribution of the above constituents is shown on the constituent concentration contour maps included in the **Figures** section.

In accordance with Section 3.4 of the July 2003 AMPP, a trend analysis was performed for the Type III monitoring wells. Pursuant to IDEM's letter dated May 5, 2005, the trend testing included all Phase II parameters listed in the AMPP. However, note that meaningful trend testing can only be conducted on parameters that had a detection frequency greater than 50 percent. The Mann-Kendall trend analyses for the Type III Area are included in **Appendix C1**. The following statistically significant upward trends were identified at the Type III monitoring wells:

- Boron (dissolved) at MW-3; and
- Specific Conductivity (field) at MW-3.

Pursuant to Section 3.4 in the July 2003 AMPP, the GWPS was considered achieved unless a statistically significant upward trend was identified AND the existing concentration for that constituent was greater than the most stringent regulatory level.

There is no GWPS for specific conductivity, therefore the groundwater protection standard is considered achieved for this constituent. However, concentrations of boron (dissolved) at MW-3 exhibited a statistically significant upward trend and the current concentration exceeded the most stringent regulatory level/GWPS.

As a follow-up step to these findings, an evaluation of the monitoring network in the vicinity of the Type III wells exhibiting exceedances and points downgradient was performed. According to the groundwater elevation contour maps provided as **Figures 1** and **2**, groundwater from these wells discharges to Brown Ditch near SG-4 and SG-5, ultimately flowing downstream to SG-2 and then SG-6. Boron (dissolved) was not found above the surface water protection standard (SWPS) in SG-4, SG-5, or SG-6, although, surface water sampling location SG-2 exhibited boron (dissolved) concentrations greater than the SWPS. However, SG-6 is representative of water leaving the site at the compliance point. Since SG-6 does not exhibit concentrations of boron (dissolved) above the SWPS, water leaving the site meets the applicable water quality standards. The groundwater quality and trends at wells located within the supplemental closure site will continue to be monitored on a regular basis.

In accordance with Item 9 in Section 3.4 of the July 2003 AMPP for the Type III Area, we are herein providing IDEM with notification that secondary standards have been identified at concentrations exceeding two times the Secondary Maximum Contaminant Level (SMCL).

- Manganese (dissolved) (MW-3 only);
- Sulfate (total) (MW-3 only); and
- Total dissolved solids (MW-3 only).

Groundwater monitoring will continue at the Type III Area in accordance with the IDEM approved July 2003 AMPP. The next semi-annual groundwater sampling event for the Type III monitoring wells is scheduled for April 2013.

## 5.2 Temporary Monitoring Wells

The analytical results from the October 2012 sampling event for the temporary wells TW-12, TW-15D, TW-15S, TW-16D, TW-16S, TW-17D, TW-17S, TW-18D, TW-18S, TW-19D and TW-19S are summarized on **Table 6**. Based upon available information, the wells are located either upgradient or sidegradient of the Type II North Area. The analytical results have been compared to the GWPS since activities within the Type II Area are in accordance with Phase II assessment monitoring. Concentrations of the following parameters exceed the GWPS at at least one temporary well:

- Arsenic (dissolved);
- Boron (dissolved);
- Iron (dissolved);
- Manganese (dissolved);
- Molybdenum (dissolved);
- pH (field);
- Potassium (dissolved); and
- Sulfate (total).

The spatial distribution of select constituents listed above is shown on the constituent concentration contour maps included in the **Figures** section.

## 6.0 SURFACE WATER SAMPLING

Surface water samples were collected at six locations in conjunction with the October 2012 groundwater sampling event. One Brown Ditch water sample was collected from a location upstream of Yard 520 (SG-1A). Three surface water samples were collected from midstream locations SG-3, SG-4 and SG-5. Two additional surface water samples were collected downstream of Yard 520 (SG-2 and SG-6) (see **Figure 1** for sampling locations). A field duplicate sample was obtained from the upstream sampling location (SG-1A) and labeled "SW-Dup". Field activities were implemented in accordance with the approved Surface Water Sampling Plan for the facility dated August 28, 1997 (revised September 29, 1998). The October 2012 laboratory analytical results are presented in **Appendix D** (digital submission of the analytical results was transmitted to IDEM through the e-mail address OLQDATA@idem.in.gov).

### 6.1 Statistical Analysis

Pursuant to the AMPP, surface water data was compared to the surface water protection standards (SWPS) listed on **Table 7**. The concentrations of the following parameters were identified at concentrations exceeding the SWPS:

- Boron (dissolved) at SG-2 (*downstream*);
- Potassium (dissolved) at SG-2 (*downstream*), SG-3, SG-4, SG-5, and SG-6;
- Sodium (dissolved) at SG-3;
- Specific Conductivity at SG-2 (*downstream*);
- Sulfate at SG-2 (*downstream*); and
- Total dissolved solids at SG-2 (*downstream*).

Sampling location SG-6 is located at the downstream property boundary on the east side of the facility and is therefore the critical compliance point. Sample location SG-6 did not exhibit constituents exceeding the SWPS, with the exception of potassium (dissolved). However, the SWPS for potassium (dissolved) is the background prediction limit. No health-based standards have been established for potassium, likely due to its low toxicity. Because potassium is not linked to any health or toxicological concentration standards, the concentration observed at SG-6 does not pose a threat to human health.

The surface water locations mentioned above will continue to be monitored in accordance with the October 11, 2004 plan approved by IDEM in a letter dated November 10, 2004 and IDEM's August 12, 2005 letter.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| ***Monitoring Wells*** | | | | | | | | | | | |
| MW-1R | Type II | GW Sampling | up | 2 | 2342181.85 | 2985885.47 | 626.48 | 625.81 | 624.06 | 31.01 | 12.16 |
| P-2 | Type II | Water Levels | NA | 2 | 2342114.84 | 2986770.99 | 622.41 | 621.78 | 619.66 | 19.92 | 8.61 |
| MW-3 | Type III | GW Sampling | NA | 2 | 2341669.65 | 2986943.77 | 617.98 | 617.75 | 616.00 | 17.42 | 10.85 |
| MW-3A | Type III | Water Levels | NA | 2 | 2341549.26 | 2986991.37 | 623.44 | 623.26 | 620.90 | 22.17 | 12.80 |
| MW-4 | Type III | GW Sampling | NA | 2 | 2341355.96 | 2986308.61 | 620.67 | 620.49 | 619.10 | 18.61 | 12.78 |
| MW-4A | Type III | Water Levels | NA | 2 | 2341198.37 | 2986316.29 | 624.12 | 623.88 | 621.20 | 49.82 | 9.92 |
| MW-5 | Type II | Water Levels | NA | 2 | 2342880.34 | 2987478.67 | 610.36 | 610.19 | 608.90 | 9.64 | 3.96 |
| MW-6 | Type II | GW Sampling | side | 2 | 2342964.71 | 2986858.11 | 632.12 | 631.59 | 628.87 | 35.80 | 18.10 |
| MW-7 | Type II | GW Sampling | side | 2 | 2342646.50 | 2986507.53 | 630.28 | 629.83 | 624.90 | 26.33 | 16.24 |
| MW-8 | Type II | GW Sampling | down | 2 | 2342554.26 | 2987401.46 | 616.31 | 615.84 | 612.40 | 17.72 | 10.07 |
| P-9 | Type III | Water Levels | NA | 1 | 2341939.89 | 2987406.45 | 621.30 | 620.79 | 617.60 | NA | 13.46 |
| P-10 | Type II | Water Levels | NA | 1 | 2341608.06 | 2985822.07 | 617.62 | 617.04 | 614.50 | NA | 4.87 |
| MW-10* | Type II | GW Sampling | NA | 2 | 2341599.02 | 2985821.03 | 616.74 | 615.98 | 614.50 | 12.65 | 3.84 |
| MW-11 | Type II | GW Sampling | down | 2 | 2343020.71 | 2987440.39 | 612.45 | 611.97 | 609.60 | 17.51 | 5.35 |
| TW-12 | Type II | GW Sampling | NA | 2 | 2342507.05 | 2986469.33 | 631.82 | 631.36 | 628.50 | 34.01 | 18.18 |
| MW-13D* | Type II | GW Sampling | up | 2 | 2342423.93 | 2986012.31 | 627.68 | 626.97 | 625.50 | 33.49 | 13.56 |
| MW-13S* | Type II | GW Sampling | up | 2 | 2342422.51 | 2986011.01 | 627.74 | 626.97 | 625.50 | 17.75 | 12.86 |
| MW-14D* | Type II | GW Sampling | up | 2 | 2342690.01 | 2986316.53 | 628.45 | 627.75 | 626.10 | 35.81 | 14.64 |
| MW-14S* | Type II | GW Sampling | up | 2 | 2342688.04 | 2986314.00 | 628.46 | 627.78 | 626.10 | 19.07 | 14.01 |
| TW-15D | Type II | GW Sampling | NA | 2 | 2343009.03 | 2986697.79 | 630.36 | 629.71 | 628.00 | 38.31 | 16.19 |
| TW-15S | Type II | GW Sampling | NA | 2 | 2343007.38 | 2986696.01 | 630.43 | 629.60 | 628.00 | 22.20 | 16.10 |
| TW-16D | NA | GW Sampling | NA | 2 | 2343444.10 | 2987255.26 | 632.09 | 631.45 | 630.00 | 42.00 | 21.70 |
| TW-16S | NA | GW Sampling | NA | 2 | 2343443.09 | 2987253.13 | 632.12 | 631.38 | 630.00 | 26.93 | 21.14 |
| TW-17D | NA | GW Sampling | NA | 2 | 2343241.73 | 2986720.82 | 634.08 | 633.38 | 631.90 | 33.00 | 21.70 |
| TW-17S | NA | GW Sampling | NA | 2 | 2343239.73 | 2986720.55 | 634.08 | 633.42 | 631.90 | 27.58 | 21.13 |
| TW-18D | NA | GW Sampling | NA | 2 | 2343478.41 | 2987037.36 | 636.88 | 636.32 | 634.80 | 46.21 | 26.19 |
| TW-18S | NA | GW Sampling | NA | 2 | 2343480.95 | 2987037.93 | 637.10 | 636.41 | 634.80 | 28.10 | 25.47 |
| TW-19D | NA | GW Sampling | NA | 2 | 2343595.76 | 2987392.83 | 633.26 | 632.70 | 630.30 | 44.31 | 23.46 |
| TW-19S | NA | GW Sampling | NA | 2 | 2343597.60 | 2987392.25 | 633.25 | 632.81 | 630.30 | 28.19 | 23.41 |
| P-20 | Type II | Water Levels | NA | 1 | 2342142.00 | 2986841.00 | 622.77 | 622.12 | -- | NA | 9.66 |
| P-21 | Type II | Water Levels | down | 2 | 2342481.09 | 2987500.80 | 624.79 | 624.25 | 621.88 | 17.61 | 12.08 |
| Pz-1 | Type II | Water Levels | NA | 1 | 2341738.51 | 2985857.78 | 621.52 | 621.03 | 617.93 | NA | 7.86 |
| Pz-2 | Type II | Water Levels | NA | 1 | 2341664.39 | 2985862.68 | 623.10 | 622.35 | 619.55 | NA | 4.38 |
| Pz-3 | Type II | Water Levels | NA | 1 | 2341482.86 | 2985881.53 | 621.63 | 620.95 | 617.86 | NA | 8.11 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| ***Stream Gauges*** | | | | | | | | | | | |
| SG-1** | Type III | NA | up | 2341036.02 | 2985886.45 | 612.54 | NA | NA | NA | NA | |
| SG-1A** | Type III | SW Sampling | up | 2340871.71 | 2985621.50 | 613.40 | 612.65 | 605.99 | 4.60 | 610.59 | |
| SG-2 | Type III | SW Sampling | down | NA | NA | 607.87 | 607.86 | 601.83 | 3.98 | 605.81 | |
| SG-3 | Type III | SW Sampling | middle | 2341338.61 | 2985882.45 | 611.38 | 611.38 | 604.72 | NA | NA | |
| SG-4 | Type III | SW Sampling | middle | NA | NA | NA | NA | NA | NA | NA | |
| SG-5 | Type III | SW Sampling | middle | NA | NA | 607.26 | 607.25 | 601.20 | NA | NA | |
| SG-6 | Type III | SW Sampling | down | 2342917.32 | 2987975.55 | 608.33 | 608.33 | 601.67 | 2.74 | 604.41 | |

Monitoring locations originally surveyed on Sept. 9, 2002 by Marbach, Brady & Weaver, Inc.
Monitoring locations MW-1, MW-6, MW-7, MW-11, TW-12, P-2, and P-20 re-surveyed on by Weaver Boos Consultants.
*Formerly known as TW-10, TW-13D, TW-13S, TW-14D, and TW-14S.
**SG-1 removed from network in January 2003 and replaced with SG-1A.

NA - Not available, stream gauge underwater.

**Table 4**
**Summary of Analytical Results - Type II Area Monitoring Wells**
**October 2012 Semi-Annual Monitoring Event**
**Yard 520 Restricted Waste Site**
**Pines, Indiana**

| Parameter Name | Units | Prediction Limit[1] | Regulatory Levels | | | | | Groundwater Protection Standard (GWPS)[3] | Type II Area | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Upgradient Wells | | | | | Downgradient Wells | | | Sidegradient Wells[2] | |
| | | | MCL | Action Level | SMCL | DWEL | Removal Action Level | | MW-1R[4] | MW-13D | MW-13S | MW-14D | MW-14S | MW-11 | MW-10 | MW-8 | MW-6 | MW-7 |
| Arsenic, dissolved | mg/L | 0.02 | **0.01** | -- | -- | 0.01 | 0.05 | 0.02 | 0.016 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | **0.064** | **0.22** | **0.027** |
| Barium, dissolved | mg/L | 0.29 | **2.0** | -- | -- | 2.0 | 2.0 | 2.0 | 0.29 | 0.32 | 0.14 | 0.34 | 0.091 | 0.25 | 0.19 | 0.29 | 0.11 | 0.09 |
| Boron, dissolved | mg/L | 5.5 | -- | -- | -- | **3.0** | 0.9 | 5.5 | 3.3 | 0.18 | 0.42 | 1.8 | **7.8** | **13** | **17** | **44** | **31** | **6.2** |
| Cadmium, dissolved | mg/L | 0.005 | **0.005** | -- | -- | 0.02 | 0.005 | 0.005 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Chloride | mg/L | 1700 | -- | -- | **250** | -- | -- | 1700 | 750 | **2100** | 1000 | 1100 | 290 | 750 | 210 | 58 | 9.5 | 7.5 |
| Chromium, dissolved | mg/L | 0.07 | **0.1** | -- | -- | 0.1 | 0.2 | 0.1 | <0.070 | <0.070 | <0.070 | <0.070 | <0.070 | <0.070 | <0.070 | <0.070 | <0.070 | <0.070 |
| Copper, dissolved | mg/L | 0.01 | 1.3 | 1.3 | **1.0** | -- | 1.3 | 1.0 | 0.011 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Cyanide, total | mg/L | 0.0086 | **0.2**** | -- | -- | 0.8 | 0.2 | 0.2 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 |
| Fluoride | mg/L | 0.43 | 4.0 | -- | **2.0** | -- | 5.0 | 2.0 | 0.11 | <0.10 | <0.10 | <0.10 | 0.2 | <0.10 | 0.68 | 0.43 | 0.1 | 0.17 |
| Iron, dissolved | mg/L | 6.71 | -- | -- | **0.3** | -- | -- | 6.71 | **12** | 2.2 | 0.12 | 1.6 | <0.050 | **20** | 0.093 | **7.5** | 1.2 | **14** |
| Lead, dissolved | mg/L | 0.1 | **0.015** | 0.015 | -- | -- | 0.03 | 0.1 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Manganese, dissolved | mg/L | 0.87 | -- | -- | **0.05** | -- | -- | 0.87 | **1.7** | 0.8 | 0.25 | 0.53 | 0.016 | 0.57 | 0.043 | 0.71 | 0.5 | **1.0** |
| Mercury, dissolved | mg/L | 0.002 | **0.002** | -- | -- | 0.01 | 0.01 | 0.002 | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 | <0.0020 |
| Molybdenum, dissolved | mg/L | 0.116 | -- | -- | -- | 0.2 | **0.01** | 0.116 | 0.036 | <0.010 | 0.019 | 0.021 | 0.012 | <0.010 | 0.065 | <0.010 | **0.54** | 0.075 |
| Nickel, dissolved | mg/L | 0.02 | -- | -- | -- | 0.7 | **0.5** | 0.5 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| Nitrate | mg/L | 8.4 | **10.0** | -- | -- | -- | 10 | 10.0 | 0.11 | <0.10 | 1.8 | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 | <0.10 |
| pH, Field | SU | 6.30-8.00 | -- | -- | **6.5 - 8.5** | -- | -- | 6.3-8.5 | 6.83 | 6.49 | **6.26** | 6.60 | 7.59 | 6.85 | **6.03** | 7.03 | **6.2** | 6.92 |
| Potassium, dissolved | mg/L | 14.53 | -- | -- | -- | -- | -- | 14.53 | 12 | 5.9 | 7.7 | 7.3 | 3.2 | 3.5 | **41** | **32** | **46** | 6.8 |
| Selenium, dissolved | mg/L | 0.0054 | **0.05** | -- | -- | 0.2 | 0.2 | 0.05 | 0.014 | <0.0050 | 0.0096 | <0.0050 | <0.0050 | <0.0050 | 0.0051 | <0.0050 | <0.0050 | <0.0050 |
| Silver, dissolved | mg/L | 0.07 | -- | -- | **0.1** | 0.2 | 0.1 | 0.1 | <0.070 | <0.070 | <0.070 | <0.070 | <0.070 | <0.070 | <0.070 | <0.070 | <0.0070 | <0.070 |
| Sodium, dissolved | mg/L | 910 | -- | -- | -- | -- | -- | 910 | 320 | **1200** | 790 | 680 | 190 | 360 | 450 | 78 | 31 | 20 |
| Specific Conductivity, Field | umhos/cm | 5780 | -- | -- | -- | -- | -- | 5780 | 3016 | **6920** | 4469 | 3984 | 1886 | 3666 | 2614 | 2064 | 2064 | 1667 |
| Sulfate, total | mg/L | 150 | -- | -- | **250** | -- | 250 | 250 | 240 | 120 | 160 | 200 | 200 | **430** | **580** | **680** | **550.0** | 43 |
| Sulfide, total | mg/L | 0.39 | -- | -- | -- | -- | -- | 0.39 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | **3.8** | <1.0 | <1.0 | <1.0 |
| Total Dissolved Solids | mg/L | 3400 | -- | -- | **500** | -- | -- | 3400 | 2000 | **4300** | 2700 | 2500 | 1200 | 2400 | 2000 | 1700 | 1700 | 990 |
| Zinc, dissolved | mg/L | 0.041 | -- | -- | 5.0 | 10 | **3.0** | 3.0 | 0.022 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.0020 | <0.020 |

-- Indicates Not Available

GWPS applicable to upgradient/downgradient wells (straight arithmetic comparison).

Applicable standard for sidegradient wells is considered exceeded if BOTH a statistically significant upward trend AND a concentration greater than the GWPS is identified.

A concentration above the GWPS is indicated by: **1.6**

A concentration has BOTH a statistically significant upward trend AND is above the GWPS indicated by: **20** (applicable only to sidegradient wells)

** MCL is for free Cyanide

DWEL - Drinking Water Equivalent Level

MCL - Maximum Contaminant Level

SMCL - Secondary Maximum Contaminant Level

Regulatory levels for Action Levels, DWELs, MCLs, and SMCLs were obtained from the *2002 Edition of the Drinking Water Standards and Health Advisories* , Summer 2002, EPA 822-R-02-038.

Removal Action Levels were obtained from USEPA Memorandum, *Retransmittal of the Latest Superfund Removal Action Levels* , April 1997, EPA-540-F-99-004.

[1]Prediction limits as indicated on Table 8 of the December 2003 Revised Statistical Evaluation Plan.

[2]Pursuant to the August 2004 Assessment Monitoring Program Plan a comparison to Prediction Limits is not conducted for sidegradient wells.

[3]GWPS as indicated on Table 2 of the August 2004 Assessment Monitoring Program Plan.

[4]MW-1R replaced MW -1, which was abandoned on April 10, 2008 using the overdrill method in accordance with 312 lAC 13-10-2.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| Arsenic, dissolved | mg/L | | -- | -- | 0.01 | 0.05 | | |
| Barium, dissolved | mg/L | | -- | -- | 2.0 | 2.0 | 0.035 | 0.11 |
| Boron, dissolved | mg/L | -- | -- | -- | 3.0 | | | |
| Cadmium, dissolved | mg/L | | -- | -- | 0.02 | 0.005 | <0.0050 | <0.0050 |
| Chloride | mg/L | -- | -- | | -- | -- | 48 | 90 |
| Chromium, dissolved | mg/L | | -- | -- | 0.1 | 0.2 | <0.070 | <0.070 |
| Copper, dissolved | mg/L | 1.3 | 1.3 | | -- | 1.3 | 0.03 | <0.010 |
| Cyanide, total | mg/L | | -- | -- | 0.8 | 0.2 | <0.20 | <0.20 |
| Fluoride | mg/L | 4.0 | -- | | -- | 5.0 | 0.42 | 0.62 |
| Iron, dissolved | mg/L | -- | -- | | -- | -- | <0.050 | <0.050 |
| Lead, dissolved | mg/L | | 0.015 | -- | -- | 0.03 | <0.0050 | <0.0050 |
| Manganese, dissolved | mg/L | -- | -- | | -- | -- | | 0.033 |
| Mercury, dissolved | mg/L | | -- | -- | 0.01 | 0.01 | <0.0020 | <0.0020 |
| Molybdenum, dissolved | mg/L | -- | -- | -- | 0.2 | | | |
| Nickel, dissolved | mg/L | -- | -- | -- | 0.7 | | <0.020 | <0.020 |
| Nitrate | mg/L | | -- | -- | -- | 10 | <0.10 | <0.10 |
| pH, Field | SU | -- | -- | | -- | -- | 7.41 | 6.58 |
| Potassium, dissolved | mg/L | -- | -- | -- | -- | -- | 87 | 2.8 |
| Selenium, dissolved | mg/L | | -- | -- | 0.2 | 0.2 | <0.0050 | 0.013 |
| Silver, dissolved | mg/L | -- | -- | | 0.2 | 0.1 | <0.070 | <0.070 |
| Sodium, dissolved | mg/L | -- | -- | -- | -- | -- | 880 | 97 |
| Specific Conductivity, Field | umhos/cm | -- | -- | -- | -- | -- | 4489 | 814 |
| Sulfate, total | mg/L | -- | -- | | -- | 250 | | <10 |
| Sulfide, total | mg/L | -- | -- | -- | -- | -- | <1.0 | <1.0 |
| Total Dissolved Solids | mg/L | -- | -- | | -- | -- | | 440 |
| Zinc, dissolved | mg/L | -- | -- | 5.0 | 10 | | <0.020 | <0.020 |

-- Indicates Not Available

A concentration above the most stringent regulatory level ( ) is indicated by

** MCL is for free Cyanide

DWEL - Drinking Water Equivalent Level

MCL - Maximum Contaminant Level

SMCL - Secondary Maximum Contaminant Level

Regulatory levels for Action Levels, DWELs, MCLs, and SMCLs were obtained from the *2002 Edition of the Drinking Water Standards and Health Advisories* , Summer 2002, EPA 822-R-02-038.

Removal Action Levels were obtained from USEPA Memorandum, *Retransmittal of the Latest Superfund Removal Action Levels* , April 1997, EPA-540-F-99-004.

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic, dissolved | mg/L | | -- | -- | 0.01 | 0.05 | 0.02 | | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Boron, dissolved | mg/L | -- | -- | -- | 3.0 | | 5.5 | | 4 | 0.27 | | 0.65 | 0.63 | 0.11 | 1 | 0.13 | 2.2 | 0.15 |
| Chloride | mg/L | -- | -- | | -- | -- | 1700 | 8.5 | 850 | 450 | 650 | 300 | 500 | 26 | 700 | 61 | 1400 | 14 |
| Iron, dissolved | mg/L | -- | -- | | -- | -- | 6.71 | 3.8 | 1.9 | <0.050 | 0.22 | <0.050 | | | 0.088 | <0.050 | <0.050 | <0.050 |
| Lead, dissolved | mg/L | | 0.015 | -- | -- | 0.03 | 0.1 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 | <0.0050 |
| Manganese, dissolved | mg/L | -- | -- | | -- | -- | 0.87 | | | 0.013 | | <0.010 | 0.25 | 0.27 | | 0.012 | | 0.019 |
| Molybdenum, dissolved | mg/L | -- | -- | -- | 0.2 | | 0.116 | | 0.023 | 0.028 | <0.010 | <0.010 | <0.010 | <0.010 | 0.023 | <0.010 | 0.093 | 0.012 |
| Nickel, dissolved | mg/L | -- | -- | -- | 0.7 | | 0.5 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 | <0.020 |
| pH, Field | SU | -- | -- | | -- | -- | 6.3-8.5 | 7.35 | | | 6.44 | 7.09 | 7.61 | 7.31 | 8.13 | 7.97 | 7.38 | 7.72 |
| Potassium, dissolved | mg/L | -- | -- | -- | -- | -- | 14.5 | 9.3 | 9.8 | 1.5 | 14 | 4.8 | 1.9 | 1.1 | 5 | 3.9 | | 1.6 |
| Sodium, dissolved | mg/L | -- | -- | -- | -- | -- | 910 | 18 | 460 | 170 | 480 | 150 | 280 | 23 | 330 | 50 | 790 | 14 |
| Specific Conductivity, Field | umhos/cm | -- | -- | -- | -- | -- | 5780 | 1499 | 3608 | 1177 | 3714 | 740 | 1525 | 632 | 2024 | 427.2 | 4589 | 200 |
| Sulfate, total | mg/L | -- | -- | | -- | 250 | 250 | | | 41 | | 140 | 40 | 29 | 62 | 58 | 110 | 32 |
| Sulfide, total | mg/L | -- | -- | -- | -- | -- | 0.39 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 | <1.0 |
| Total Dissolved Solids | mg/L | -- | -- | | -- | -- | 3400 | 1200 | 2300 | 640 | 2500 | 770 | 840 | 130 | 1100 | 250 | 2800 | 110 |

-- Indicates Not Available
A concentration above the GWPS is indicated by:
** MCL is for free Cyanide
DWEL - Drinking Water Equivalent Level
MCL - Maximum Contaminant Level
SMCL - Secondary Maximum Contaminant Level
Regulatory levels for Action Levels, DWELs, MCLs, and SMCLs were obtained from the *2002 Edition of the Drinking Water Standards and Health Advisories* , Summer 2002, EPA 822-R-02-038.
Removal Action Levels were obtained from USEPA Memorandum, *Retransmittal of the Latest Superfund Removal Action Levels* , April 1997, EPA-540-F-99-004.
[1]GWPS as indicated on Table 2 of the August 2004 Assessment Monitoring Program Plan.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
| Arsenic, dissolved | mg/L | 0.01 | 0.3398 [R] | 0.23 (ND) | --- | 0.23 | <0.010 | 0.14 | <0.010 | <0.010 | <0.010 | <0.010 |
| Barium, dissolved | mg/L | 0.113 | 3.87 [T2] | --- | --- | 3.87 | 0.09 | 0.11 | 0.097 | -- | -- | -- |
| Boron, dissolved | mg/L | 0.21 | 3.2 [T2] | --- | --- | 3.2 | 0.17 | | 0.39 | 0.28 | 0.57 | 1.2 |
| Cadmium, dissolved | mg/L | 0.005 | 0.0142 [R] | 0.014 (D) [T1]<br>1.4 (ND) | --- | 0.0142[R] | <0.0050 | <0.0050 | <0.0050 | -- | -- | -- |
| Chloride | mg/L | 71 | 860 [R] | --- | --- | 860[R] | 58 | 38 | 120 | -- | -- | -- |
| Chromium, dissolved | mg/L | 0.07 | 1.36 [R] | --- | --- | 1.36[R] | <0.070 | <0.070 | <0.070 | -- | -- | -- |
| Copper, dissolved | mg/L | 0.01 | 0.0366 [R] | 0.280 (D) [T1]<br>56 (ND) | --- | 0.0366[R] | <0.010 | <0.010 | <0.010 | -- | -- | -- |
| Cyanide, total** | mg/L | 0.0072 | 0.022 [R] | 0.6 (D) [R]<br>48 (ND) [R] | --- | 0.022 | <0.20 | <0.20 | <0.20 | -- | -- | -- |
| Fluoride | mg/L | 0.62 | 12 [T2] | --- | --- | 12 | 0.27 | 0.66 | 0.24 | -- | -- | -- |
| Iron, dissolved | mg/L | 12.1 | --- | --- | --- | 12.1 | 0.45 | 0.2 | 1.8 | 2.8 | 0.47 | 0.21 |
| Lead, dissolved | mg/L | 0.005 | 0.475 [T1] | --- | --- | 0.475 | <0.0050 | <0.0050 | <0.0050 | -- | -- | -- |
| Manganese, dissolved | mg/L | 0.35 | 2.9 [T2] | --- | --- | 2.9 | 0.12 | 0.84 | 0.46 | 0.4 | 0.23 | 0.056 |
| Mercury, dissolved | mg/L | 0.002 | 0.0014399 [R] | 0.0000018 (D) [R]<br>0.0000018 (ND) | 0.0000013 [R] | 0.002 | <0.0020 | <0.0020 | <0.0020 | -- | -- | -- |
| Molybdenum, dissolved | mg/L | 0.13 | 1.2 [T2] | --- | --- | 1.2 | <0.010 | <0.010 | <0.010 | <0.010 | 0.021 | 0.024 |
| Nickel, dissolved | mg/L | 0.02 | 1.15 [R] | 0.46 (D) [T1]<br>42 (ND) | --- | 1.15[R] | <0.020 | <0.020 | <0.020 | -- | -- | -- |
| Nitrate | mg/L | 0.56 | --- | --- | --- | 0.56 | <0.10 | 0.18 | <0.10 | -- | -- | -- |
| pH, Field | SU | 4.35-9.82 | --- | --- | --- | 4.35-9.82 | 5.82 | 5.62 | 6.62 | 6.52 | 7.04 | 7.17 |
| Potassium, dissolved | mg/L | 3.44 | --- | --- | --- | 3.44 | 2.9 | | | | | |
| Selenium, dissolved | mg/L | 0.005 | --- | --- | --- | 0.005 | <0.0050 | <0.0050 | <0.0050 | -- | -- | -- |
| Silver, dissolved | mg/L | 0.07 | --- | 26 (ND) | --- | 26 | <0.070 | <0.070 | <0.070 | -- | -- | -- |
| Sodium, dissolved | mg/L | 69 | --- | --- | --- | 69 | 43 | 50 | | 37 | 51 | 59 |
| Specific Conductivity, Field | umhos/cm | 1,002 | --- | --- | --- | 1002 | 876 | | 892 | 625 | 767 | 820 |
| Sulfate, total | mg/L | 210 | --- | --- | --- | 210 | 42 | | 56 | 53 | 56 | 59 |
| Sulfide, total | mg/L | 0.05 | --- | --- | --- | 0.05 | <1.0 | <1.0 | <1.0 | -- | -- | -- |
| Total Dissolved Solids | mg/L | 653 | --- | --- | --- | 653 | 370 | | 520 | 430 | 460 | 470 |
| Zinc, dissolved | mg/L | 0.02 | | 9 (D) [T1]<br>250 (ND) | --- | 0.289[R] | <0.020 | <0.020 | 0.021 | -- | -- | -- |

-- Indicates Not Available

-- - Not Analyzed

A concentration above the SWPS is indicated by:

* Surface water quality standards as provided in 327 IAC 2-1.5.

** Surface water quality standard for cyanide (free) utilized since a standard for cyanide (total) has not been established.

***The EQL for Cyanide is the PQL listed in 40 CFR Part 258, Appendix II, and the MCL for cyanide (free).

(D) = Value id for drinking water sources

(ND) = Value is for nondrinking water sources

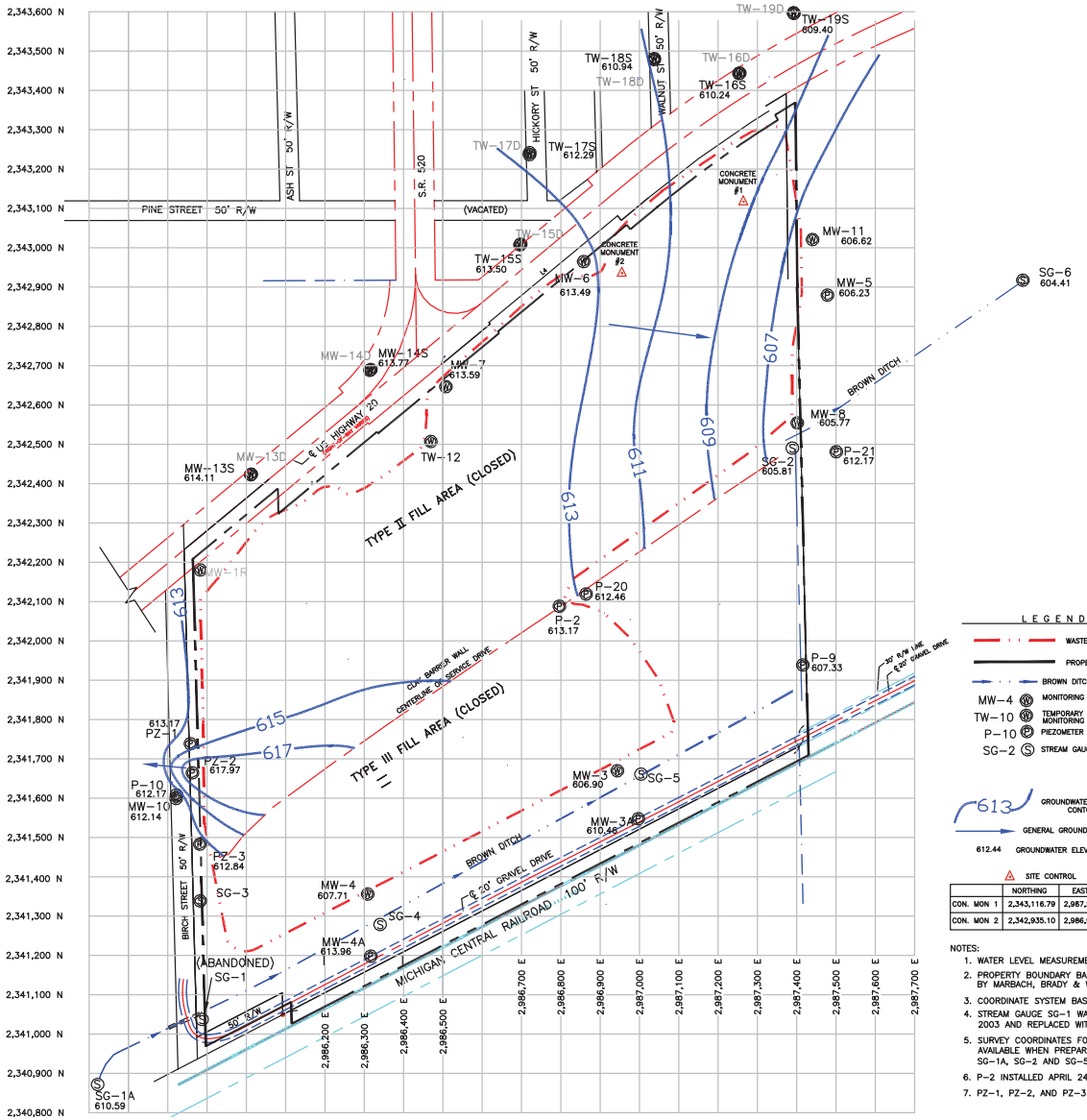
R = Value adopted into the rules during the Great Lakes Initiative rulemaking. (Note that metals criteria adopted have conversion factors and are dependant on the hardness of water.) An average hardness of 290 mg/L from area surface water locations was utilized to calculate surface water quality standards.

T1 = Value was calculated using Tier I methodology

T2 = Value was calculated using Tier II methodology

EQL - Estimated Quantitation Limit

If the EQL is less than the surface water quality standard, then the EQL will be the surface water quality standard.




| Well ID | Groundwater Elevation | Ground Surface Elevation | Date of Measurement | Time | Well Type |
|---|---|---|---|---|---|
| *Monitoring Wells / Piezometers* | | | | | |
| P-2 | 613.17 | 619.66 | 10/22/12 | 831 | Piezometer |
| MW-3 | 606.90 | 616.00 | 10/22/12 | 835 | Intrawell |
| MW-3A | 610.46 | 620.90 | 10/22/12 | 835 | Piezometer |
| MW-4 | 607.71 | 619.10 | 10/22/12 | 840 | Intrawell |
| MW-4A | 613.96 | 621.20 | 10/22/12 | 840 | Piezometer |
| MW-5 | 606.23 | 608.90 | 10/22/12 | 910 | Piezometer |
| MW-6 | 613.49 | 628.87 | 10/22/12 | 912 | Upgradient |
| MW-7 | 613.59 | 624.90 | 10/22/12 | 940 | Upgradient |
| MW-8 | 605.77 | 612.40 | 10/22/12 | 828 | Downgradient |
| P-9 | 607.33 | 617.60 | 10/22/12 | 838 | Piezometer |
| P-10 | 612.17 | 614.50 | 10/22/12 | 842 | Piezometer |
| MW-10 | 612.14 | 614.50 | 10/22/12 | 850 | Temporary |
| MW-11 | 606.62 | 609.60 | 10/22/12 | 945 | Upgradient |
| MW-13S | 614.11 | 625.50 | 10/22/12 | 853 | Upgradient |
| MW-14S | 613.77 | 626.10 | 10/22/12 | 901 | Temporary |
| TW-15S | 613.50 | 628.00 | 10/22/12 | 908 | Temporary |
| TW-16S | 610.24 | 630.00 | 10/22/12 | 928 | Temporary |
| TW-17S | 612.29 | 631.90 | 10/22/12 | 935 | Temporary |
| TW-18S | 610.94 | 634.80 | 10/22/12 | 940 | Temporary |
| TW-19S | 609.40 | 630.30 | 10/22/12 | 943 | Temporary |
| P-20 | 612.46 | 618.91 | 10/22/12 | 832 | Piezometer |
| P-21 | 612.17 | 621.88 | 10/22/12 | 832 | Piezometer |
| Pz-1 | 613.17 | 617.93 | 10/22/12 | 826 | Piezometer |
| Pz-2 | 617.97 | 619.55 | 10/22/12 | 828 | Piezometer |
| Pz-3 | 612.84 | 617.86 | 10/22/12 | 830 | Piezometer |
| *Stream Gauges* | | | | | |
| SG-1A | 610.59 | N/A | 10/22/12 | 950 | Surface Water |
| SG-2 | 605.81 | N/A | 10/22/12 | 1005 | Surface Water |
| SG-3 | NA | N/A | N/A | -- | Surface Water |
| SG-5 | NA | N/A | N/A | -- | Surface Water |
| SG-6 | 604.41 | N/A | 10/22/12 | 1240 | Surface Water |

NA - Not Available

LEGEND

- WASTE BOUNDARY (APPROXIMATE)
- PROPERTY BOUNDARY
- BROWN DITCH
- MW-4 (W) MONITORING WELL
- TW-10 (W) TEMPORARY MONITORING WELL
- P-10 (P) PIEZOMETER
- SG-2 (S) STREAM GAUGE LOCATION
- 613 GROUNDWATER ELEVATION CONTOUR
- GENERAL GROUNDWATER FLOW DIRECTION
- 612.44 GROUNDWATER ELEVATION
- SITE CONTROL

| | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.83 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

N

SCALE

0 100' 200' 300' 600'

NOTES:

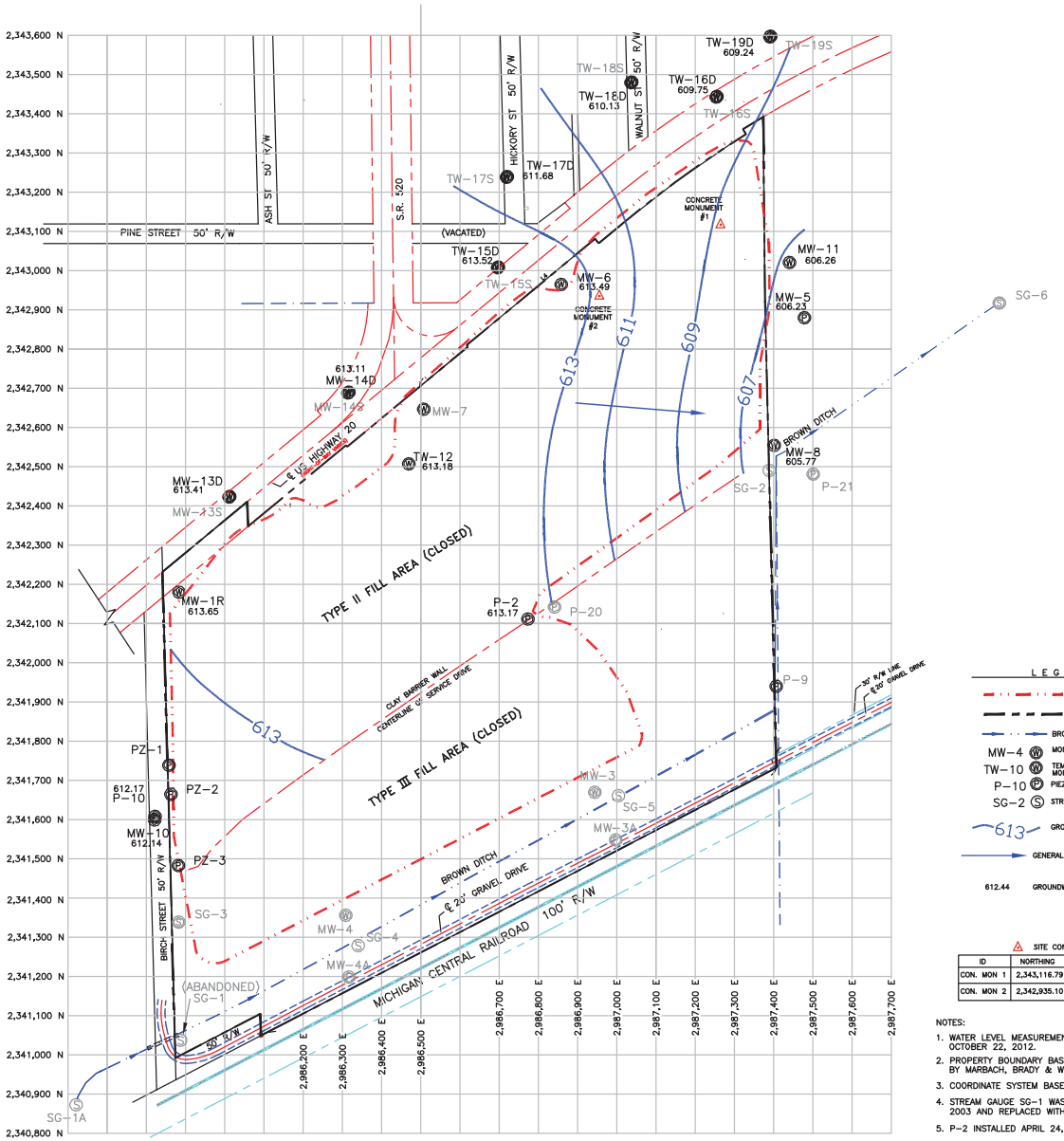
1. WATER LEVEL MEASUREMENTS OBTAINED ON OCTOBER 22, 2012.
2. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
3. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
4. STREAM GAUGE SG-1 WAS REMOVED FROM THE NETWORK IN JANUARY 2003 AND REPLACED WITH SG-1A.
5. SURVEY COORDINATES FOR SG-1A, SG-2 AND SG-5 WERE NOT AVAILABLE WHEN PREPARING THIS MAP. THEREFORE, THE LOCATIONS OF SG-1A, SG-2 AND SG-5 ARE APPROXIMATE.
6. P-2 INSTALLED APRIL 24, 2007, REPLACING DAMAGED PIEZOMETER MW-2.
7. PZ-1, PZ-2, AND PZ-3 INSTALLED JULY 20, 2011.

# GROUNDWATER ELEVATION CONTOUR MAP (OCTOBER 2012) (SHALLOW WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN
FORT WORTH, TX
COLUMBUS, OH
CHICAGO, IL
(312) 922-1030
SOUTH BEND, IN
NAPERVILLE, IL
SPRINGFIELD, IL
ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: RD | DATE: 12/19/12 | FILE: 0013-01-14 |
| REVIEWED BY: MW | CAD: 10-12-1.DWG | FIGURE 1 |




SCALE

0 100' 200' 300' 600'

N

| Well ID | Groundwater Elevation | Ground Surface Elevation | Date of Measurement | Time | Well Type |
|---|---|---|---|---|---|
| *Monitoring Wells* | | | | | |
| MW-1R | 613.65 | 624.06 | 10/22/12 | 821 | Upgradient |
| P-2 | 613.17 | 619.66 | 10/22/12 | 831 | Piezometer |
| MW-5 | 606.23 | 608.90 | 10/22/12 | 913 | Piezometer |
| MW-6 | 613.49 | 628.87 | 10/22/12 | 912 | Upgradient |
| MW-8 | 605.77 | 612.40 | 10/22/12 | 828 | Downgradient |
| P-10 | 612.17 | 614.50 | 10/22/12 | 842 | Piezometer |
| MW-10 | 612.14 | 614.50 | 10/22/12 | 859 | Temporary |
| MW-11 | 606.62 | 609.60 | 10/22/12 | 945 | Downgradient |
| TW-12 | 613.18 | 628.50 | 10/22/12 | 940 | Temporary |
| MW-13D | 613.41 | 625.50 | 10/22/12 | 855 | Upgradient |
| MW-14D | 613.11 | 626.10 | 10/22/12 | 900 | Upgradient |
| TW-15D | 613.52 | 628.00 | 10/22/12 | 908 | Temporary |
| TW-16D | 609.75 | 630.00 | 10/22/12 | 922 | Temporary |
| TW-17D | 611.68 | 631.90 | 10/22/12 | 932 | Temporary |
| TW-18D | 610.13 | 634.80 | 10/22/12 | 935 | Temporary |
| TW-19D | 609.24 | 630.30 | 10/22/12 | 937 | Temporary |

LEGEND

- WASTE BOUNDARY (APPROXIMATE)
- PROPERTY LINE (APPROXIMATE)
- BROWN DITCH
- MW-4 (W) MONITORING WELL
- TW-10 (W) TEMPORARY MONITORING WELL
- P-10 (P) PIEZOMETER
- SG-2 (S) STREAM GAUGE LOCATION
- 613 GROUNDWATER ELEVATION CONTOUR
- GENERAL GROUNDWATER FLOW DIRECTION
- 612.44 GROUNDWATER ELEVATION

SITE CONTROL

| ID | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.83 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

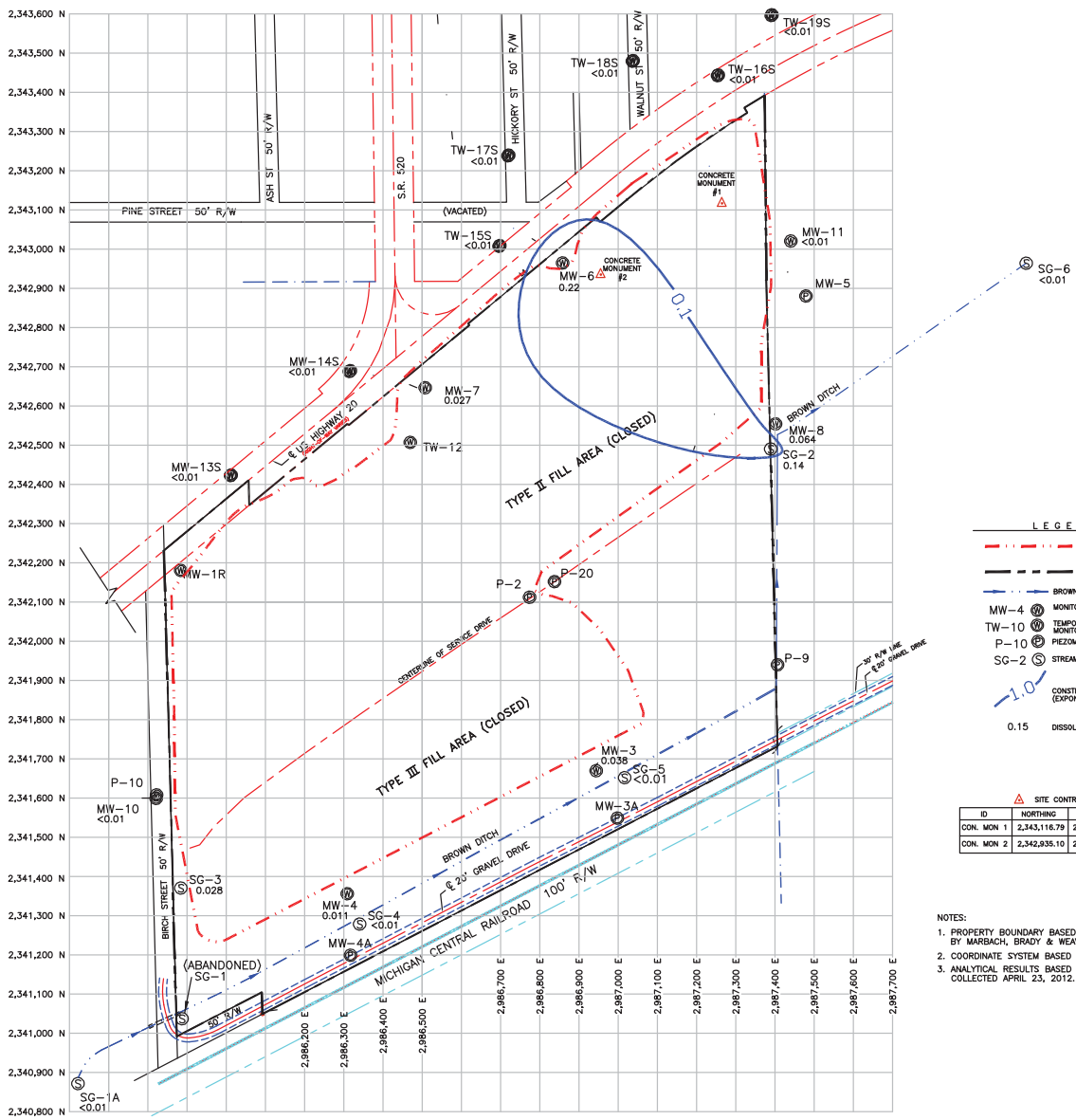
1. WATER LEVEL MEASUREMENTS OBTAINED ON OCTOBER 22, 2012.
2. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
3. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
4. STREAM GAUGE SG-1 WAS REMOVED FROM THE NETWORK IN JANUARY 2003 AND REPLACED WITH SG-1A.
5. P-2 INSTALLED APRIL 24, 2007, REPLACING DAMAGED PIEZOMETER MW-2.
6. PZ-1, PZ-2, AND PZ-3 INSTALLED JULY 20, 2011.

# GROUNDWATER ELEVATION CONTOUR MAP (OCTOBER 2012) (DEEP WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN
FORT WORTH, TX
COLUMBUS, OH
CHICAGO, IL
(312) 922-1030
SOUTH BEND, IN
NAPERVILLE, IL
SPRINGFIELD, IL
ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: RD | DATE: 11/30/2012 | FILE: 0013-01-14 |
| REVIEWED BY: MW | CAD: 10-12-2.DWG | FIGURE 2 |




SCALE

0 100' 300' 600'

N

LEGEND

- WASTE BOUNDARY (APPROXIMATE)
- PROPERTY BOUNDARY
- BROWN DITCH
- MW-4 — MONITORING WELL
- TW-10 — TEMPORARY MONITORING WELL
- P-10 — PIEZOMETER
- SG-2 — STREAM GAUGE LOCATION
- 1.0 — CONSTITUENT CONCENTRATION CONTOUR (EXPONENTIAL CONTOUR INTERVAL)
- 0.15 — DISSOLVED ARSENIC CONCENTRATION (mg/L)

SITE CONTROL

| ID | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.83 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

1. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
2. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
3. ANALYTICAL RESULTS BASED ON LABORATORY DATA COLLECTED APRIL 23, 2012.

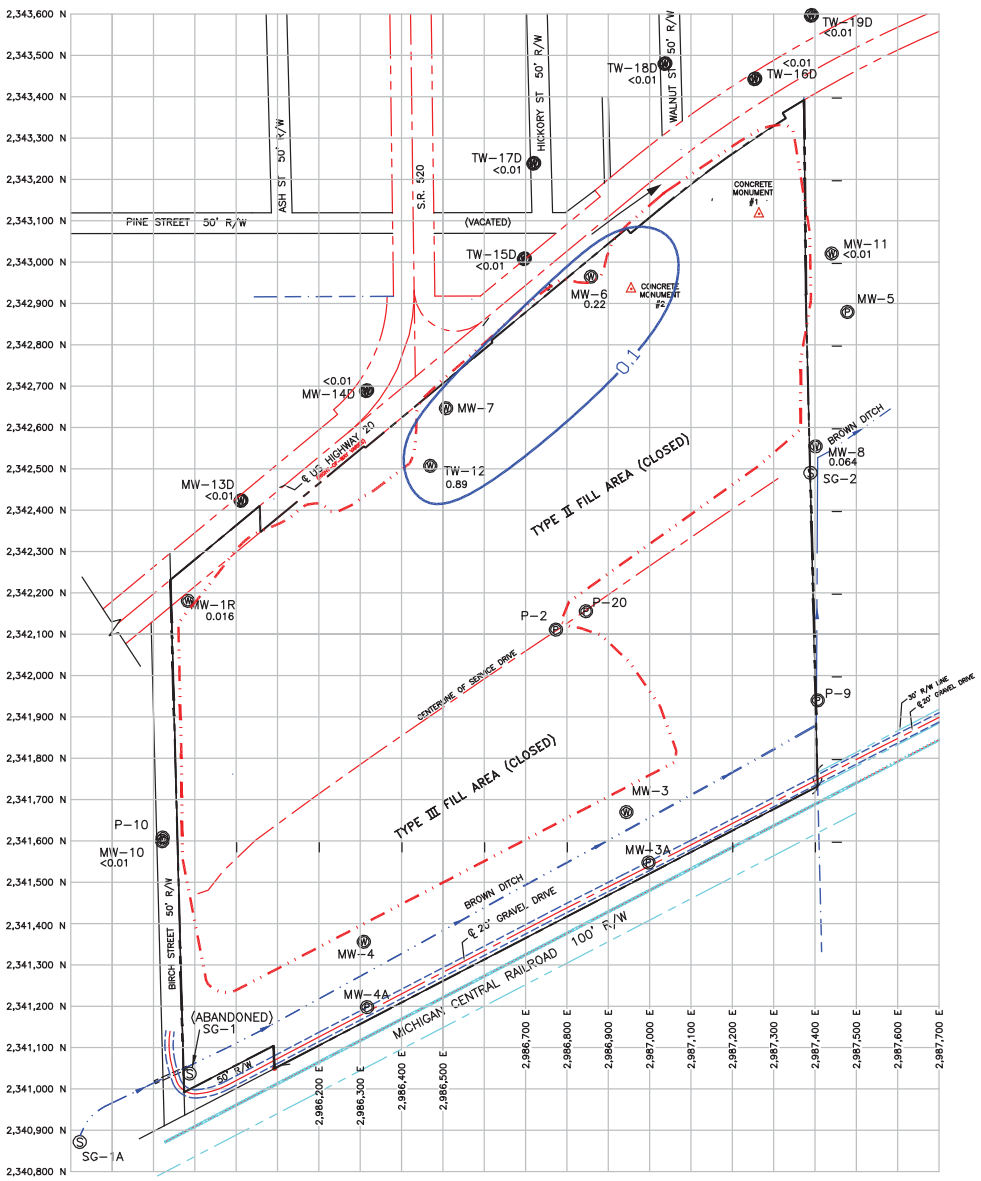
# CONSTITUENT CONCENTRATION CONTOUR MAP (OCTOBER 2012) ARSENIC, DISSOLVED (SHALLOW WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA

WEAVER BOOS CONSULTANTS, NC.

GRIFFITH, IN · FORT WORTH, TX · COLUMBUS, OH · CHICAGO, IL (312) 922-1030 · SOUTH BEND, IN · NAPERVILLE, IL · SPRINGFIELD, IL · ST. LOUIS, MO

| | | |
|---|---|---|
| DRAWN BY: RD | DATE: 11/30/2012 | FILE: 0013-01-14 |
| REVIEWED BY: MW | CAD: 10-12-3.DWG | FIGURE 3 |




SCALE

0 100' 300' 600'

N

LEGEND

- WASTE BOUNDARY (APPROXIMATE)
- PROPERTY BOUNDARY
- BROWN DITCH
- MW-4 MONITORING WELL
- TW-10 TEMPORARY MONITORING WELL
- P-10 PIEZOMETER
- SG-2 STREAM GAUGE LOCATION
- 1.0 CONSTITUENT CONCENTRATION CONTOUR (EXPONENTIAL CONTOUR INTERVAL)
- 0.15 DISSOLVED ARSENIC CONCENTRATION (mg/L)

SITE CONTROL

| ID | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.83 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

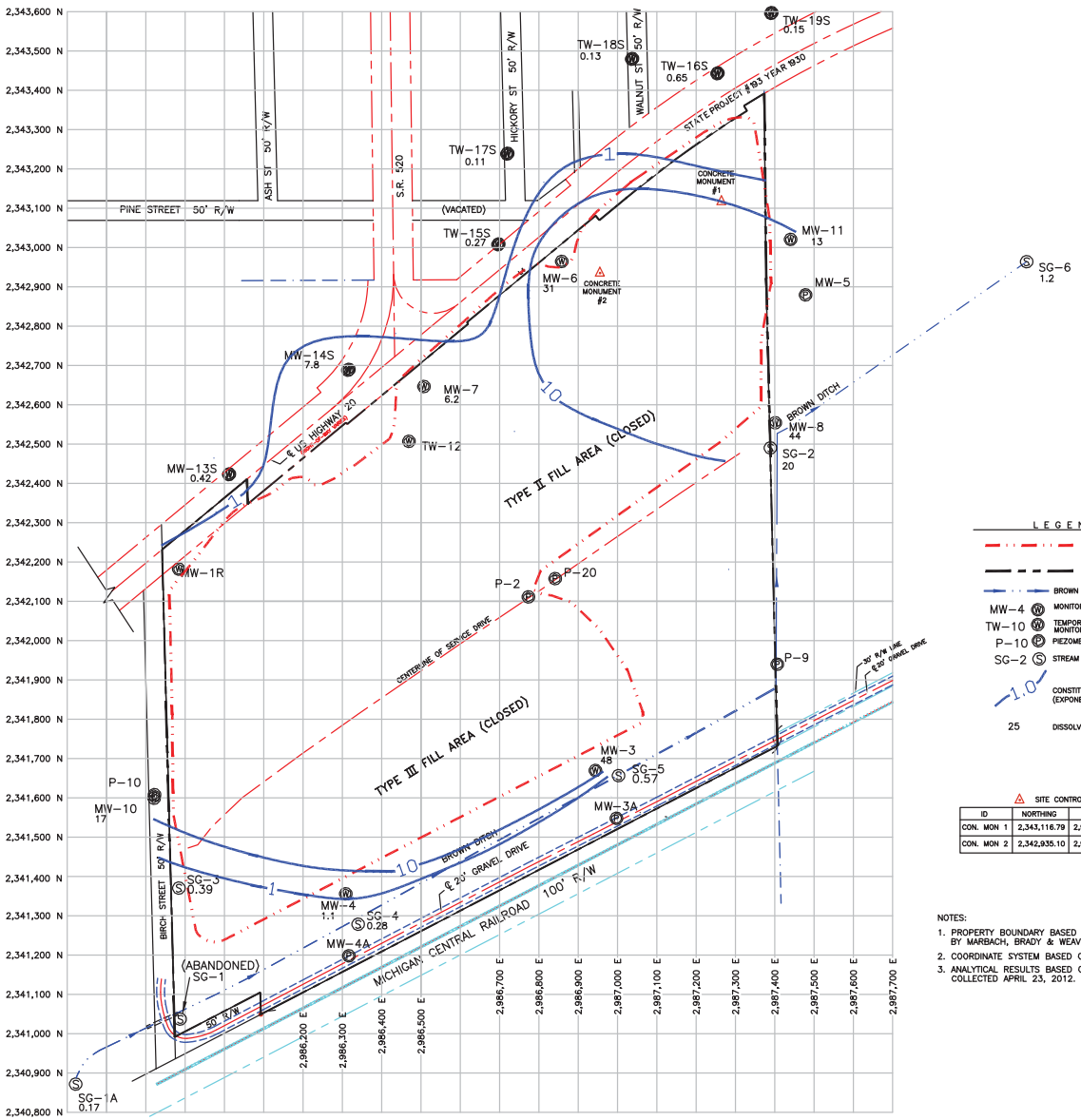
1. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
2. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
3. ANALYTICAL RESULTS BASED ON LABORATORY DATA FROM SAMPLES COLLECTED APRIL 23, 2012.

# CONSTITUENT CONCENTRATION CONTOUR MAP (OCTOBER 2012) ARSENIC, DISSOLVED (DEEP WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN · FORT WORTH, TX · COLUMBUS, OH
CHICAGO, IL (312) 922-1030 · SOUTH BEND, IN
NAPERVILLE, IL · SPRINGFIELD, IL · ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: RD | DATE: 11/30/2012 | FILE: 0013-01-14 |
| REVIEWED BY: MW | CAD: 10-12-4.DWG | FIGURE 4 |




SCALE

0 100' 300' 600'

N

LEGEND

- WASTE BOUNDARY (APPROXIMATE)
- PROPERTY BOUNDARY
- BROWN DITCH
- MW-4 MONITORING WELL
- TW-10 TEMPORARY MONITORING WELL
- P-10 PIEZOMETER
- SG-2 STREAM GAUGE LOCATION
- 1.0 CONSTITUENT CONCENTRATION CONTOUR (EXPONENTIAL CONTOUR INTERVAL)
- 25 DISSOLVED BORON CONCENTRATION (mg/L)

SITE CONTROL

| ID | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.83 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

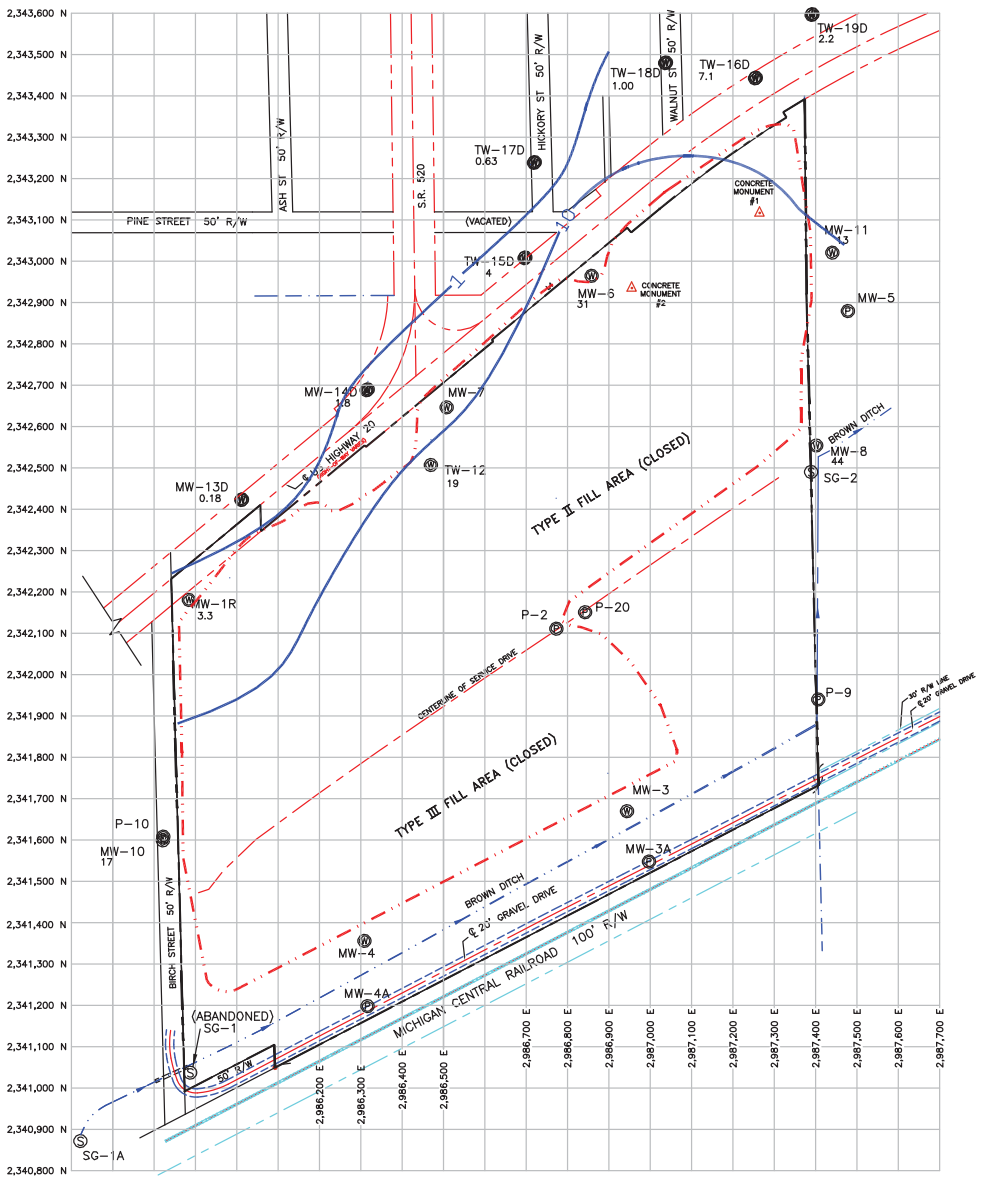
1. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
2. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
3. ANALYTICAL RESULTS BASED ON LABORATORY DATA COLLECTED APRIL 23, 2012.

# CONSTITUENT CONCENTRATION CONTOUR MAP (OCTOBER 2012) BORON, DISSOLVED (SHALLOW WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN · FORT WORTH, TX · COLUMBUS, OH
CHICAGO, IL (312) 922-1030 · SOUTH BEND, IN
NAPERVILLE, IL · SPRINGFIELD, IL · ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: RD | DATE: 11/30/2012 | FILE: 0013-01-14 |
| REVIEWED BY: MW | CAD: 10-12-5.DWG | FIGURE 5 |




SCALE

0 100' 300' 600'

N

LEGEND

- WASTE BOUNDARY (APPROXIMATE)
- PROPERTY BOUNDARY
- BROWN DITCH
- MW-4 MONITORING WELL
- TW-10 TEMPORARY MONITORING WELL
- P-10 PIEZOMETER
- SG-2 STREAM GAUGE LOCATION
- 1.0 CONSTITUENT CONCENTRATION CONTOUR (EXPONENTIAL CONTOUR INTERVAL)
- 25 DISSOLVED BORON CONCENTRATION (mg/L)

SITE CONTROL

| ID | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.83 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

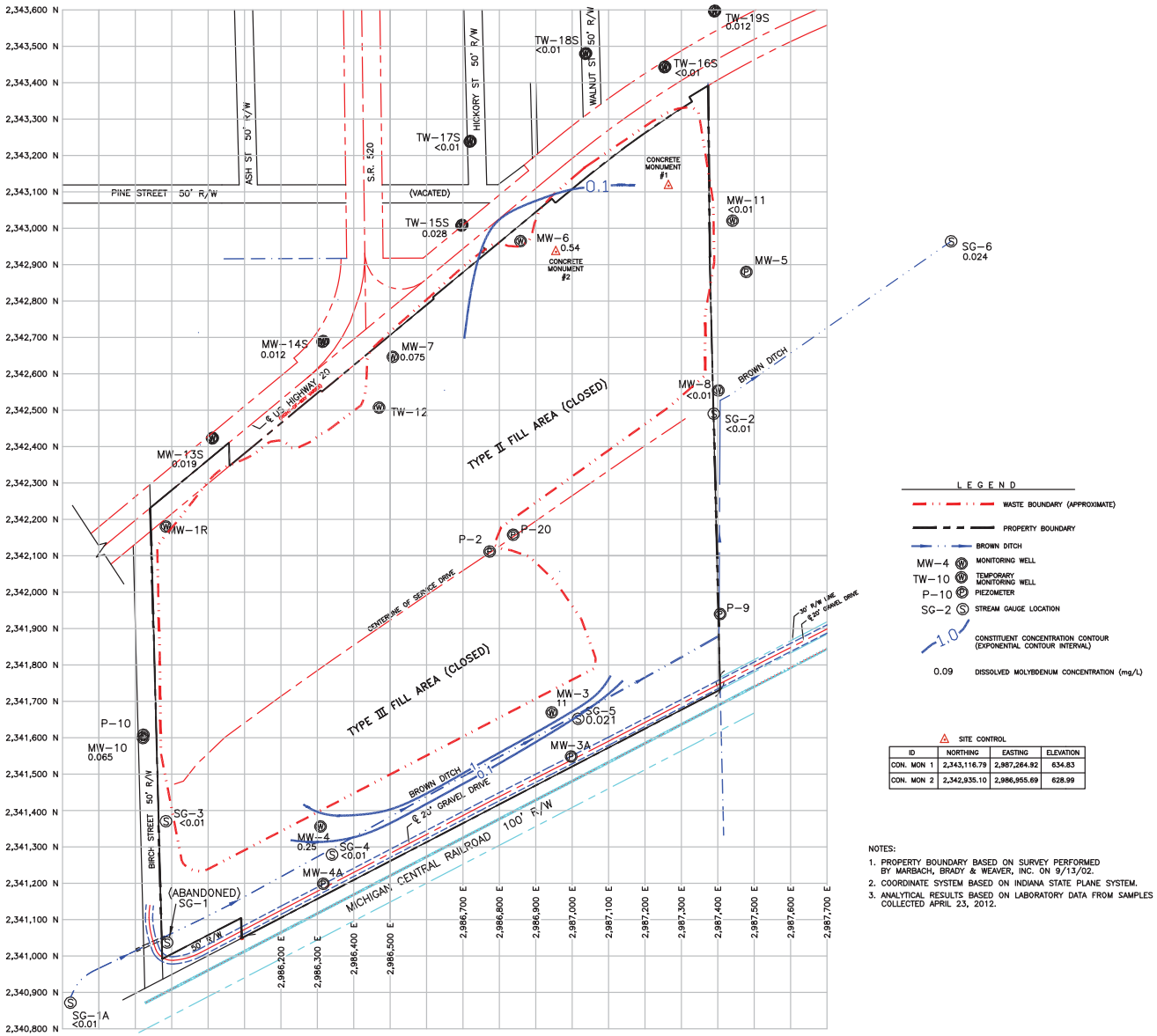
1. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
2. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
3. ANALYTICAL RESULTS BASED ON LABORATORY DATA FROM SAMPLES COLLECTED APRIL 23, 2012.

# CONSTITUENT CONCENTRATION CONTOUR MAP (OCTOBER 2012) BORON, DISSOLVED (DEEP WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN · CHICAGO, IL · NAPERVILLE, IL
FORT WORTH, TX · (312) 922-1030 · SPRINGFIELD, IL
COLUMBUS, OH · SOUTH BEND, IN · ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: RD | DATE: 11/30/2012 | FILE: 0013-01-11 |
| REVIEWED BY: MW | CAD: 10-12-6.DWG | FIGURE 6 |




SCALE

0 100' 300' 600'

N

L E G E N D

- WASTE BOUNDARY (APPROXIMATE)
- PROPERTY BOUNDARY
- BROWN DITCH
- MW-4 MONITORING WELL
- TW-10 TEMPORARY MONITORING WELL
- P-10 PIEZOMETER
- SG-2 STREAM GAUGE LOCATION
- 1.0 CONSTITUENT CONCENTRATION CONTOUR (EXPONENTIAL CONTOUR INTERVAL)
- 0.09 DISSOLVED MOLYBDENUM CONCENTRATION (mg/L)

SITE CONTROL

| ID | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.83 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

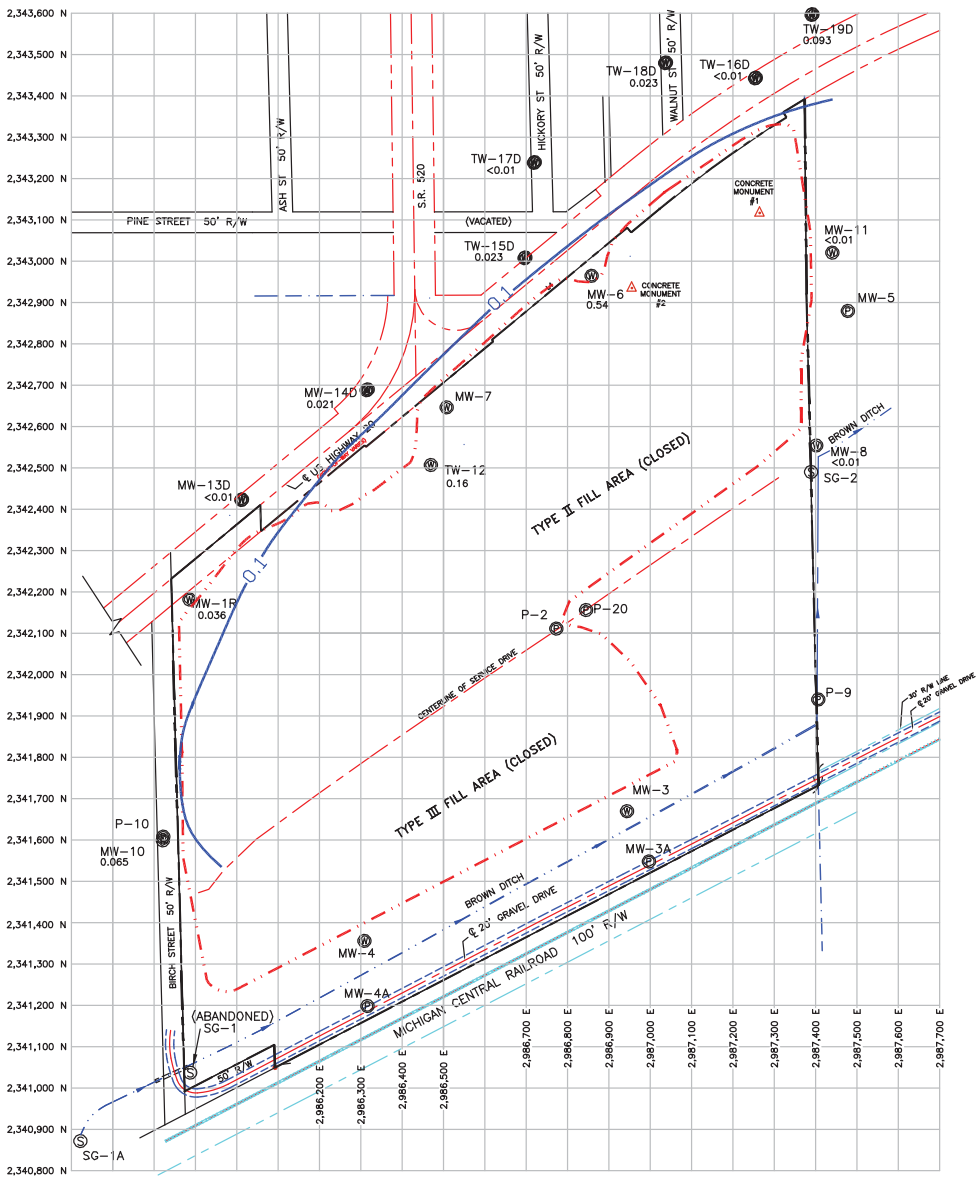
1. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
2. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
3. ANALYTICAL RESULTS BASED ON LABORATORY DATA FROM SAMPLES COLLECTED APRIL 23, 2012.

# CONSTITUENT CONCENTRATION CONTOUR MAP (OCTOBER 2012) MOLYBDENUM, DISSOLVED (SHALLOW WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA

WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN
FORT WORTH, TX
COLUMBUS, OH
CHICAGO, IL
(312) 922-1030
SOUTHBEND, IN
NAPERVILLE, IL
SPRINGFIELD, IL
ST. LOUIS, MO

| | | |
|---|---|---|
| DRAWN BY: RD | DATE: 11/30/2012 | FILE: 0013-01-14 |
| REVIEWED BY: MW | CAD: 10-12-7.DWG | FIGURE 7 |




SCALE

0 100' 300' 600'

N

L E G E N D

- WASTE BOUNDARY (APPROXIMATE)
- PROPERTY BOUNDARY
- BROWN DITCH
- MW-4 (W) MONITORING WELL
- TW-10 (W) TEMPORARY MONITORING WELL
- P-10 (P) PIEZOMETER
- SG-2 (S) STREAM GAUGE LOCATION
- 1.0 CONSTITUENT CONCENTRATION CONTOUR (EXPONENTIAL CONTOUR INTERVAL)
- 10 DISSOLVED MOLYBDENUM CONCENTRATION (mg/L)

△ SITE CONTROL

| ID | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.83 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

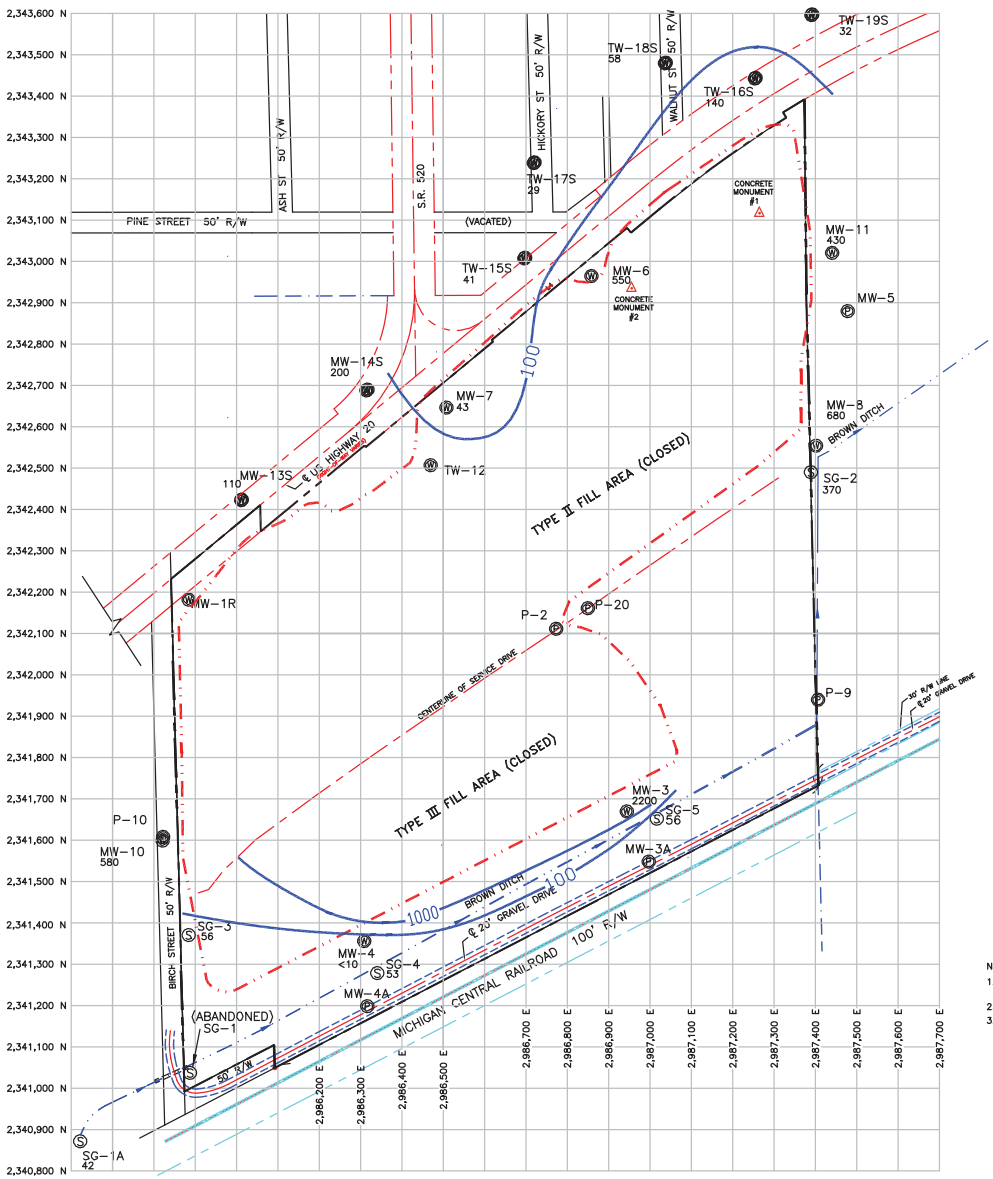
1. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
2. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
3. ANALYTICAL RESULTS BASED ON LABORATORY DATA FROM SAMPLES COLLECTED APRIL 23, 2012.

# CONSTITUENT CONCENTRATION CONTOUR MAP (OCTOBER 2012) MOLYBDENUM (DEEP WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN · FORT WORTH, TX · COLUMBUS, OH
CHICAGO, IL (312) 922-1030 · SOUTH BEND, IN
NAPERVILLE, IL · SPRINGFIELD, IL · ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: RD | DATE: 11/30/2012 | FILE: 0013-01-14 |
| REVIEWED BY: MW | CAD: 10-12-B.DWG | FIGURE 8 |




SITE CONTROL

| ID | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.83 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

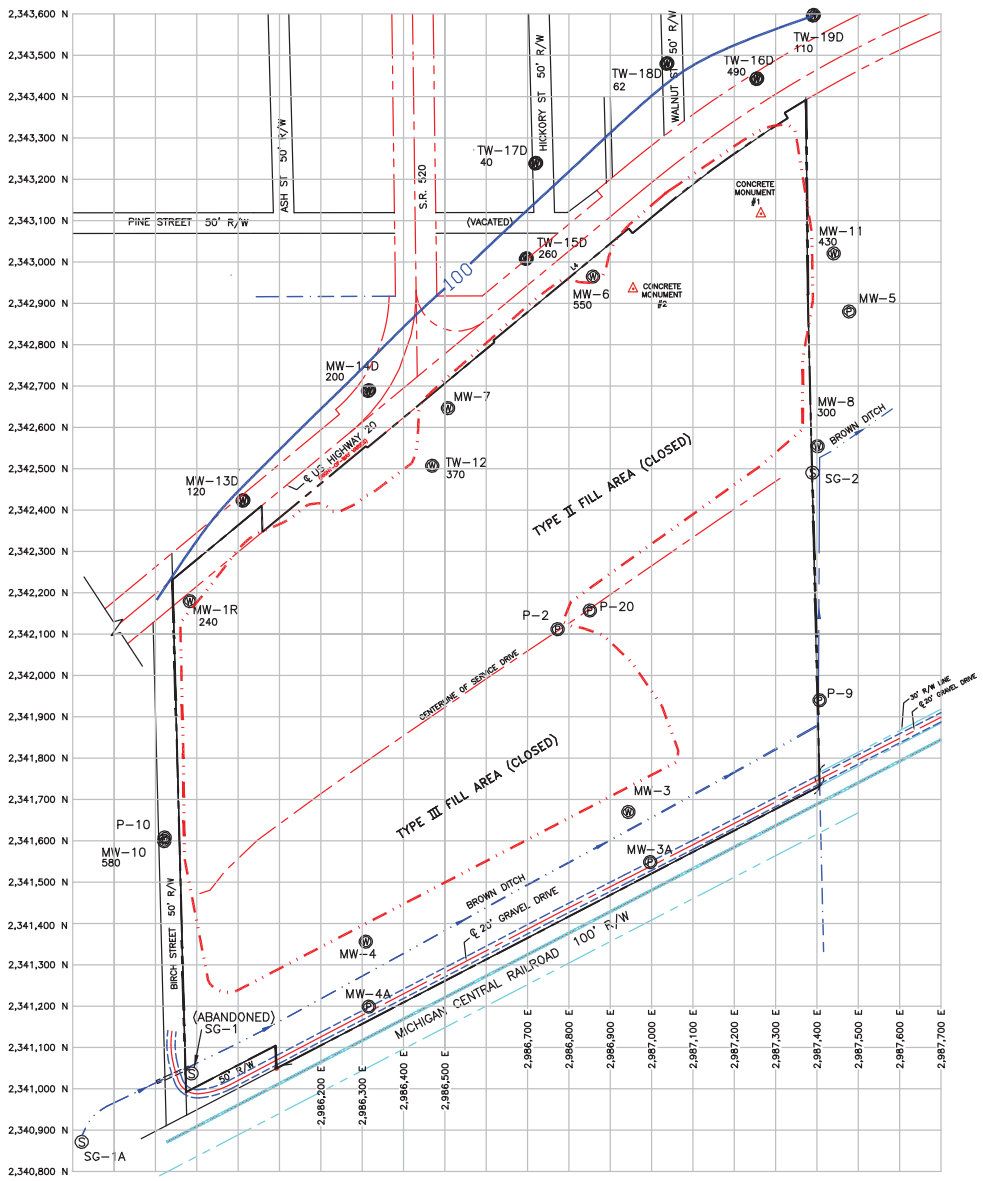
1. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
2. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
3. ANALYTICAL RESULTS BASED ON LABORATORY DATA FROM SAMPLES COLLECTED APRIL 23, 2012.

# CONSTITUENT CONCENTRATION CONTOUR MAP (OCTOBER 2012) SULFATE (SHALLOW WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN · FORT WORTH, TX · COLUMBUS, OH
CHICAGO, IL (312) 922-1030 SOUTHBEND, IN
NAPERVILLE, IL · SPRINGFIELD, IL · ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: RD | DATE: 11/30/12 | FILE: 0013-01-01 |
| REVIEWED BY: MW | CAD: 10-12-9.DWG | FIGURE 9 |




SCALE

0 100' 300' 600'

N

LEGEND

- WASTE BOUNDARY (APPROXIMATE)
- PROPERTY BOUNDARY
- BROWN DITCH
- MW-4 MONITORING WELL
- TW-10 TEMPORARY MONITORING WELL
- P-10 PIEZOMETER
- SG-2 STREAM GAUGE LOCATION
- 1.0 CONSTITUENT CONCENTRATION CONTOUR (EXPONENTIAL CONTOUR INTERVAL)
- 520 SULFATE CONCENTRATION (mg/L)

SITE CONTROL

| ID | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.83 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

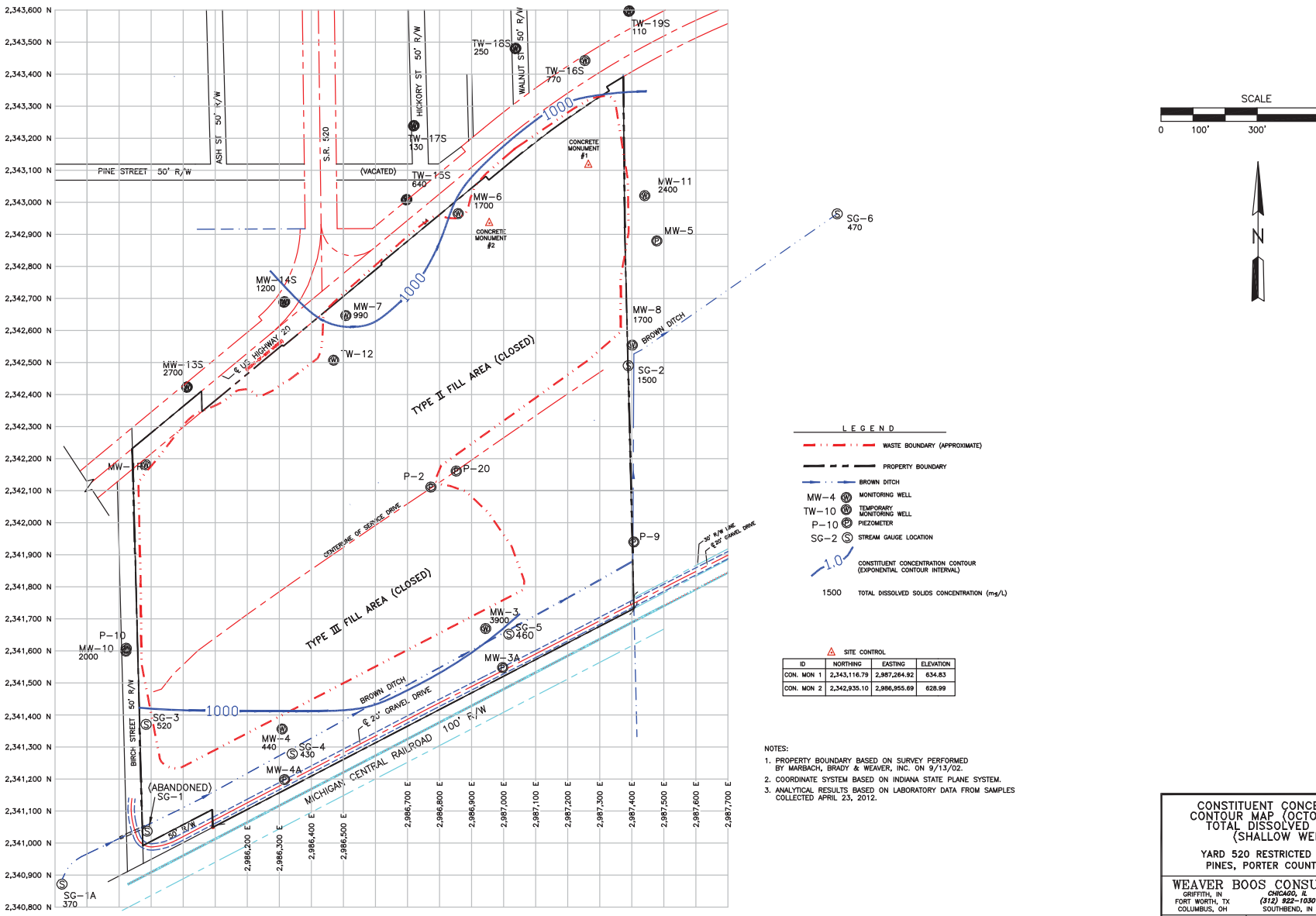
1. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
2. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
3. ANALYTICAL RESULTS BASED ON LABORATORY DATA FROM SAMPLES COLLECTED APRIL 23, 2012.

# CONSTITUENT CONCENTRATION CONTOUR MAP (OCTOBER 2012) SULFATE (DEEP WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN
FORT WORTH, TX
COLUMBUS, OH
CHICAGO, IL
(312) 922-1030
SOUTHBEND, IN
NAPERVILLE, IL
SPRINGFIELD, IL
ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: RD | DATE: 11/30/12 | FILE: 0013-01-01 |
| REVIEWED BY: MW | CAD: 10-12-10.DWG | FIGURE 10 |




SCALE

0 100' 300' 600'

N

L E G E N D

- WASTE BOUNDARY (APPROXIMATE)
- PROPERTY BOUNDARY
- BROWN DITCH
- MW-4 MONITORING WELL
- TW-10 TEMPORARY MONITORING WELL
- P-10 PIEZOMETER
- SG-2 STREAM GAUGE LOCATION
- 1.0 CONSTITUENT CONCENTRATION CONTOUR (EXPONENTIAL CONTOUR INTERVAL)
- 1500 TOTAL DISSOLVED SOLIDS CONCENTRATION (mg/L)

SITE CONTROL

| ID | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.83 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

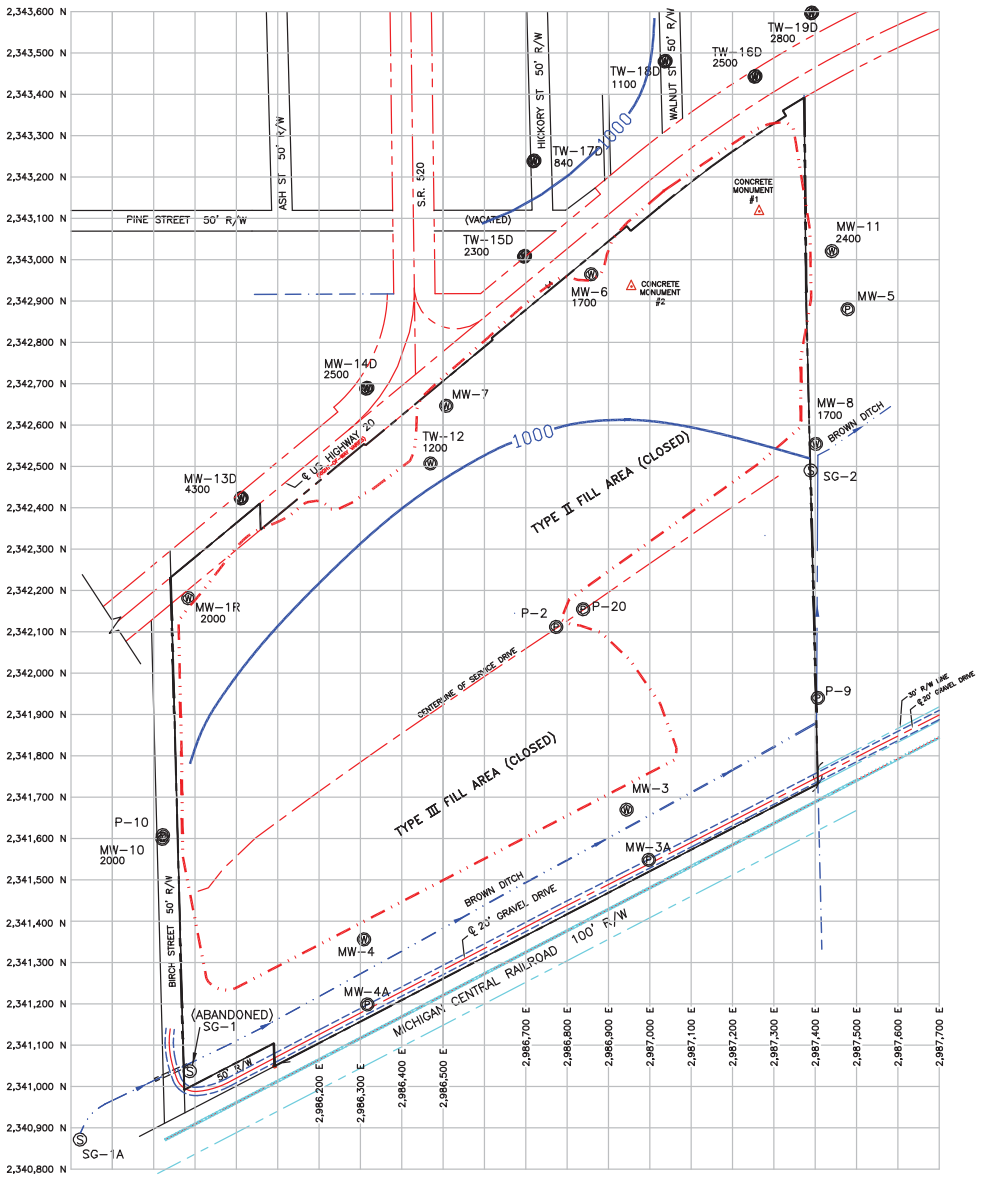
1. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
2. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
3. ANALYTICAL RESULTS BASED ON LABORATORY DATA FROM SAMPLES COLLECTED APRIL 23, 2012.

# CONSTITUENT CONCENTRATION CONTOUR MAP (OCTOBER 2012) TOTAL DISSOLVED SOLIDS (SHALLOW WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN
FORT WORTH, TX
COLUMBUS, OH
CHICAGO, IL
(312) 922-1030
SOUTHBEND, IN
NAPERVILLE, IL
SPRINGFIELD, IL
ST. LOUIS, MO


| | | |
|---|---|---|
| DRAWN BY: RD | DATE: 11/30/12 | FILE: 0013-01-01 |
| REVIEWED BY: MW | CAD: 10-12-11.DWG | FIGURE 11 |




SCALE

0 100' 300' 600'

N

LEGEND

- WASTE BOUNDARY (APPROXIMATE)
- PROPERTY BOUNDARY
- BROWN DITCH
- MW-4 MONITORING WELL
- TW-10 TEMPORARY MONITORING WELL
- P-10 PIEZOMETER
- SG-2 STREAM GAUGE LOCATION
- 1.0 CONSTITUENT CONCENTRATION CONTOUR (EXPONENTIAL CONTOUR INTERVAL)
- 1500 TOTAL DISSOLVED SOLIDS CONCENTRATION (mg/L)

SITE CONTROL

| ID | NORTHING | EASTING | ELEVATION |
|---|---|---|---|
| CON. MON 1 | 2,343,116.79 | 2,987,264.92 | 634.83 |
| CON. MON 2 | 2,342,935.10 | 2,986,955.69 | 628.99 |

NOTES:

1. PROPERTY BOUNDARY BASED ON SURVEY PERFORMED BY MARBACH, BRADY & WEAVER, INC. ON 9/13/02.
2. COORDINATE SYSTEM BASED ON INDIANA STATE PLANE SYSTEM.
3. ANALYTICAL RESULTS BASED ON LABORATORY DATA FROM SAMPLES COLLECTED APRIL 23, 2012.

# CONSTITUENT CONCENTRATION CONTOUR MAP (OCTOBER 2012) TOTAL DISSOLVED SOLIDS (DEEP WELLS)

YARD 520 RESTRICTED WASTE SITE
PINES, PORTER COUNTY, INDIANA


WEAVER BOOS CONSULTANTS, NC.
GRIFFITH, IN · FORT WORTH, TX · COLUMBUS, OH
CHICAGO, IL (312) 922-1030 SOUTHBEND, IN
NAPERVILLE, IL · SPRINGFIELD, IL · ST. LOUIS, MO

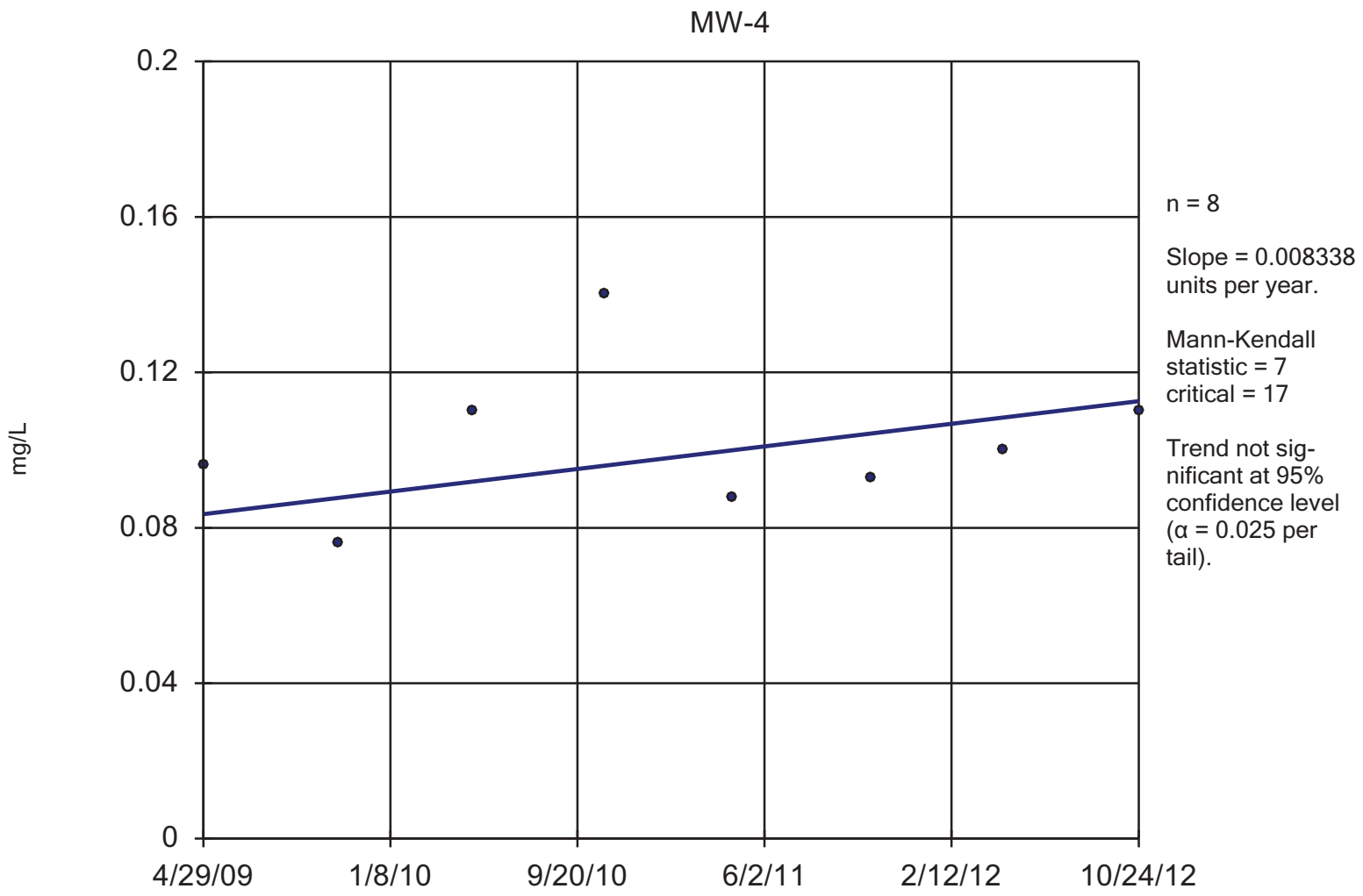

| | | |
|---|---|---|
| DRAWN BY: RD | DATE: 11/30/2012 | FILE: 0013-01-01 |
| REVIEWED BY: MW | CAD: 10-12-12 | FIGURE 12 |

# Sen's Slope/Mann-Kendall

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database  Printed 12/14/2012, 11:50 AM

| Constituent | Well | Slope | Mann-K. | Critical | Sig. | N | Alpha |
|---|---|---|---|---|---|---|---|
| Barium, dissolved (mg/L) | MW-4 | 0.008338 | 7 | 17 | No | 8 | 0.05 |
| Barium, dissolved (mg/L) | MW-3 | -0.00... | -6 | -17 | No | 8 | 0.05 |
| Boron, dissolved (mg/L) | MW-4 | -8.223 | -12 | -17 | No | 8 | 0.05 |
| **Boron, dissolved (mg/L)** | **MW-3** | **10.48** | **18** | **17** | **Yes** | **8** | **0.05** |
| Chloride (mg/L) | MW-4 | 23.03 | 8 | 17 | No | 8 | 0.05 |
| Chloride (mg/L) | MW-3 | 13.39 | 12 | 17 | No | 8 | 0.05 |
| Fluoride (mg/L) | MW-4 | -0.01004 | -4 | -17 | No | 8 | 0.05 |
| Fluoride (mg/L) | MW-3 | 0.01338 | 4 | 17 | No | 8 | 0.05 |
| **Iron, dissolved (mg/L)** | **MW-4** | **-0.3599** | **-21** | **-17** | **Yes** | **8** | **0.05** |
| Iron, dissolved (mg/L) | MW-3 | -0.05651 | -7 | -17 | No | 8 | 0.05 |
| Manganese, dissolved (mg/L) | MW-4 | 0.000... | 2 | 17 | No | 8 | 0.05 |
| Manganese, dissolved (mg/L) | MW-3 | 0.1442 | 12 | 17 | No | 8 | 0.05 |
| Molybdenum, dissolved (mg/L) | MW-4 | -1.178 | -14 | -17 | No | 8 | 0.05 |
| Molybdenum, dissolved (mg/L) | MW-3 | 2.149 | 12 | 17 | No | 8 | 0.05 |
| pH, Field (SU) | MW-4 | 0.02355 | 5 | 17 | No | 8 | 0.05 |
| pH, Field (SU) | MW-3 | 0.1104 | 6 | 17 | No | 8 | 0.05 |
| Potassium, dissolved (mg/L) | MW-4 | -4.56 | -10 | -17 | No | 8 | 0.05 |
| Potassium, dissolved (mg/L) | MW-3 | 15.29 | 9 | 17 | No | 8 | 0.05 |
| Selenium, dissolved (mg/L) | MW-4 | 0 | 7 | 17 | No | 8 | 0.05 |
| Selenium, dissolved (mg/L) | MW-3 | 0 | -1 | -17 | No | 8 | 0.05 |
| Sodium, dissolved (mg/L) | MW-4 | -13.4 | -8 | -17 | No | 8 | 0.05 |
| Sodium, dissolved (mg/L) | MW-3 | 191.7 | 14 | 17 | No | 8 | 0.05 |
| Specific Conductivity, Field (u... | MW-4 | -178.8 | -10 | -17 | No | 8 | 0.05 |
| **Specific Conductivity, Field (u...** | **MW-3** | **729.5** | **18** | **17** | **Yes** | **8** | **0.05** |
| Sulfate, total (mg/L) | MW-4 | -153.4 | -8 | -17 | No | 8 | 0.05 |
| Sulfate, total (mg/L) | MW-3 | 411.5 | 14 | 17 | No | 8 | 0.05 |
| Total Dissolved Solids (mg/L) | MW-4 | -264.1 | -9 | -17 | No | 8 | 0.05 |
| Total Dissolved Solids (mg/L) | MW-3 | 690.1 | 17 | 17 | No | 8 | 0.05 |
| Zinc, dissolved (mg/L) | MW-3 | -0.00... | -9 | -17 | No | 8 | 0.05 |

# Sen's Slope Estimator

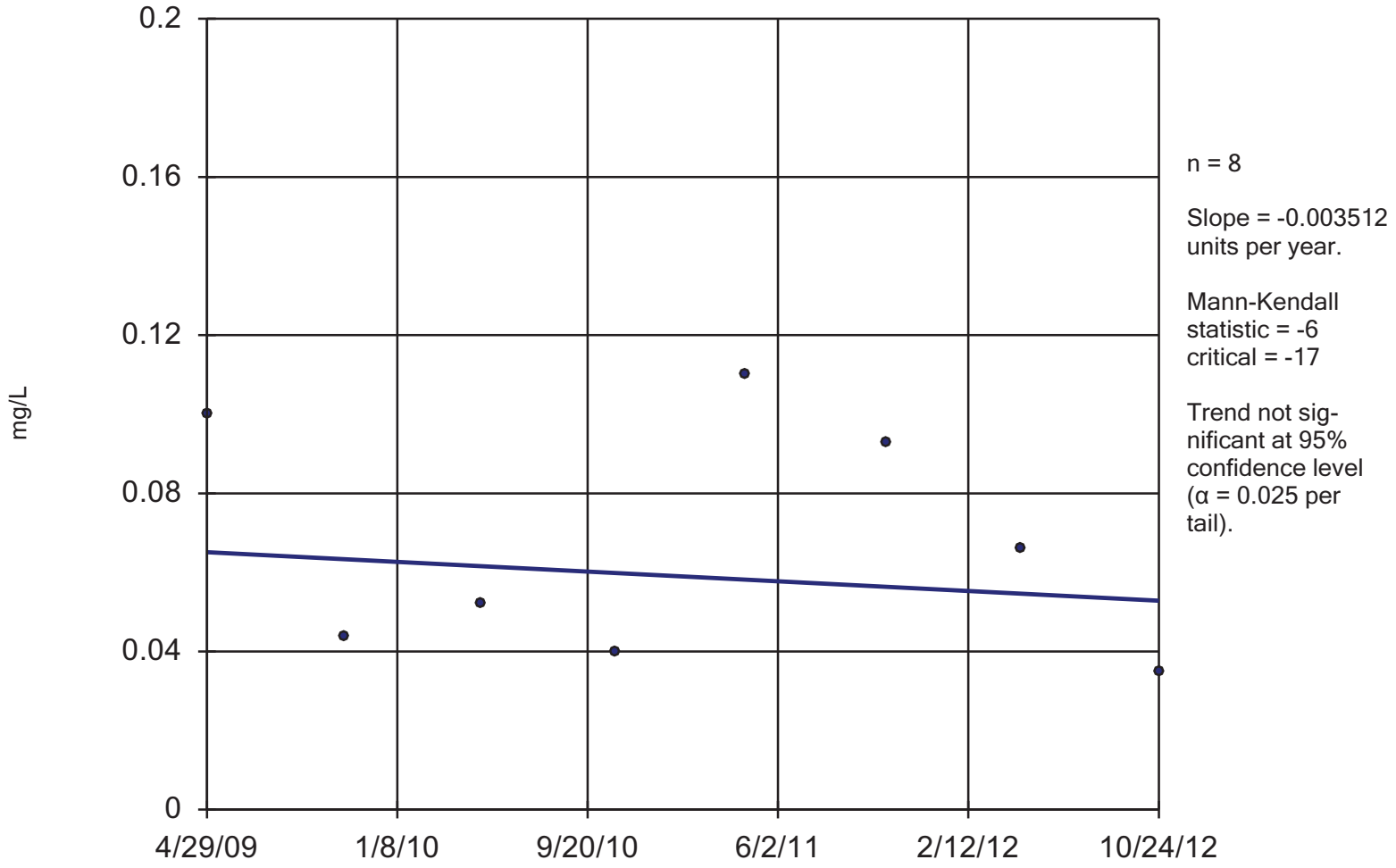



Constituent: Barium, dissolved  Analysis Run 12/14/2012 11:49 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-3

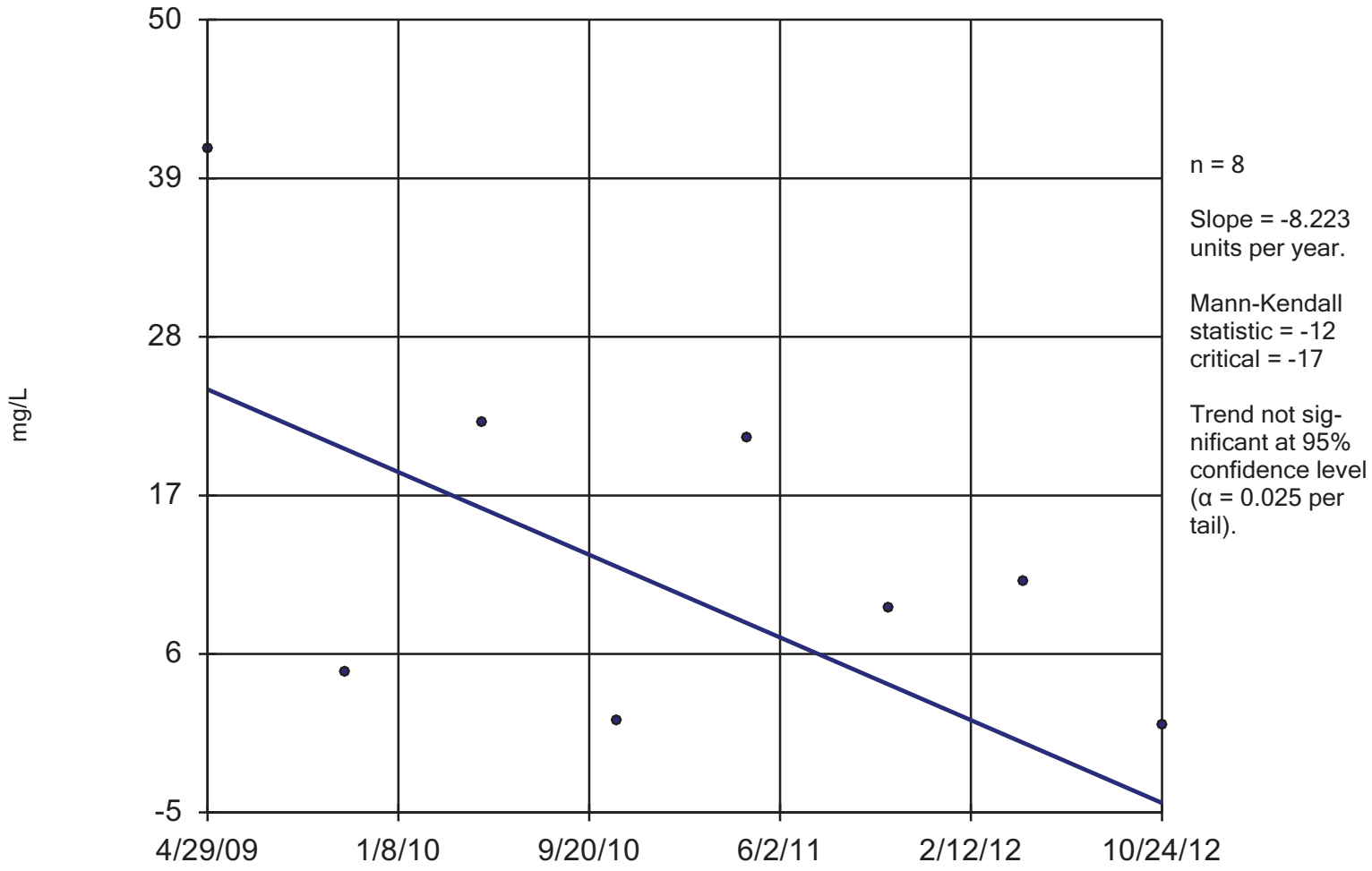



Constituent: Barium, dissolved  Analysis Run 12/14/2012 11:49 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-4

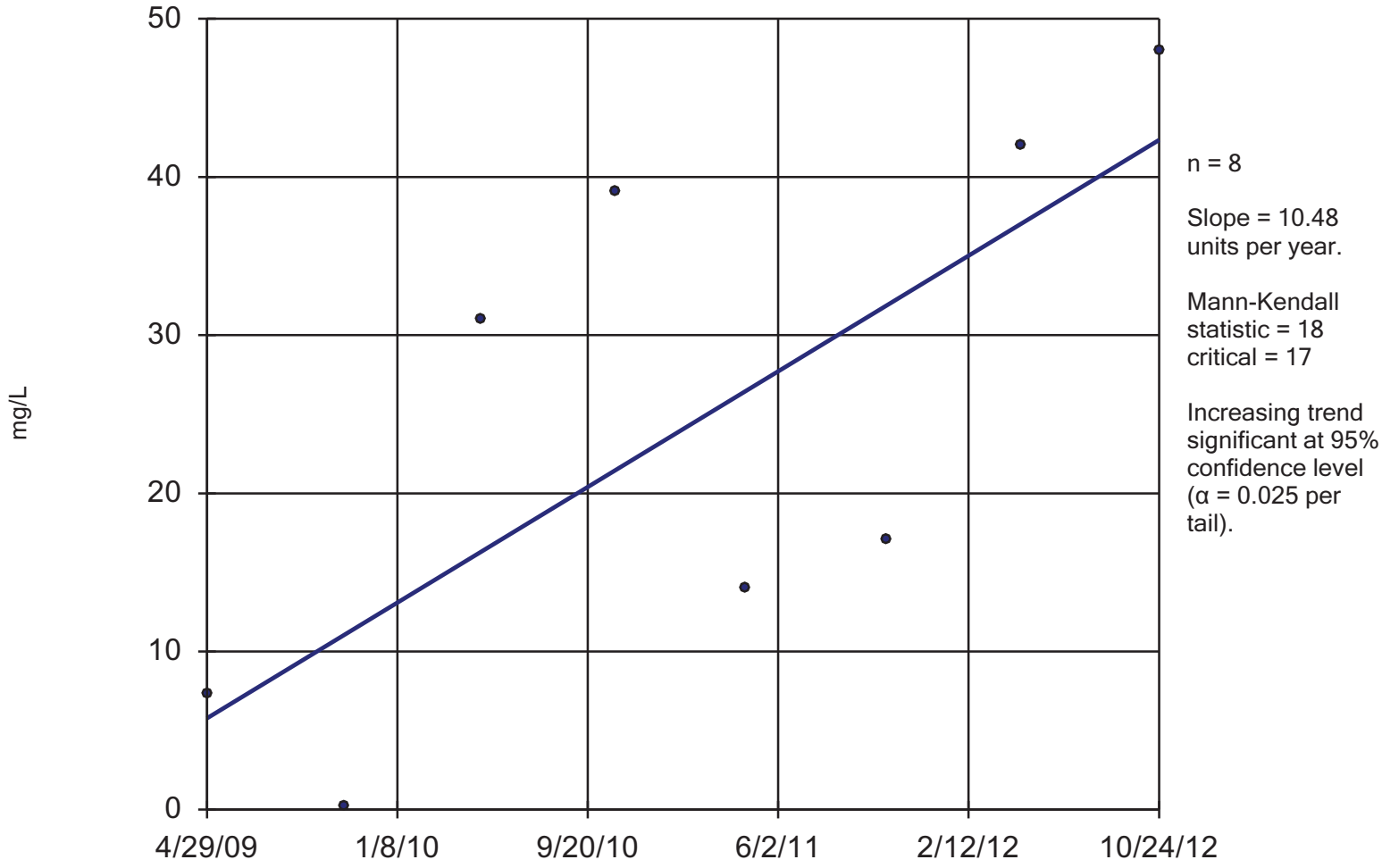



Constituent: Boron, dissolved  Analysis Run 12/14/2012 11:49 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-3

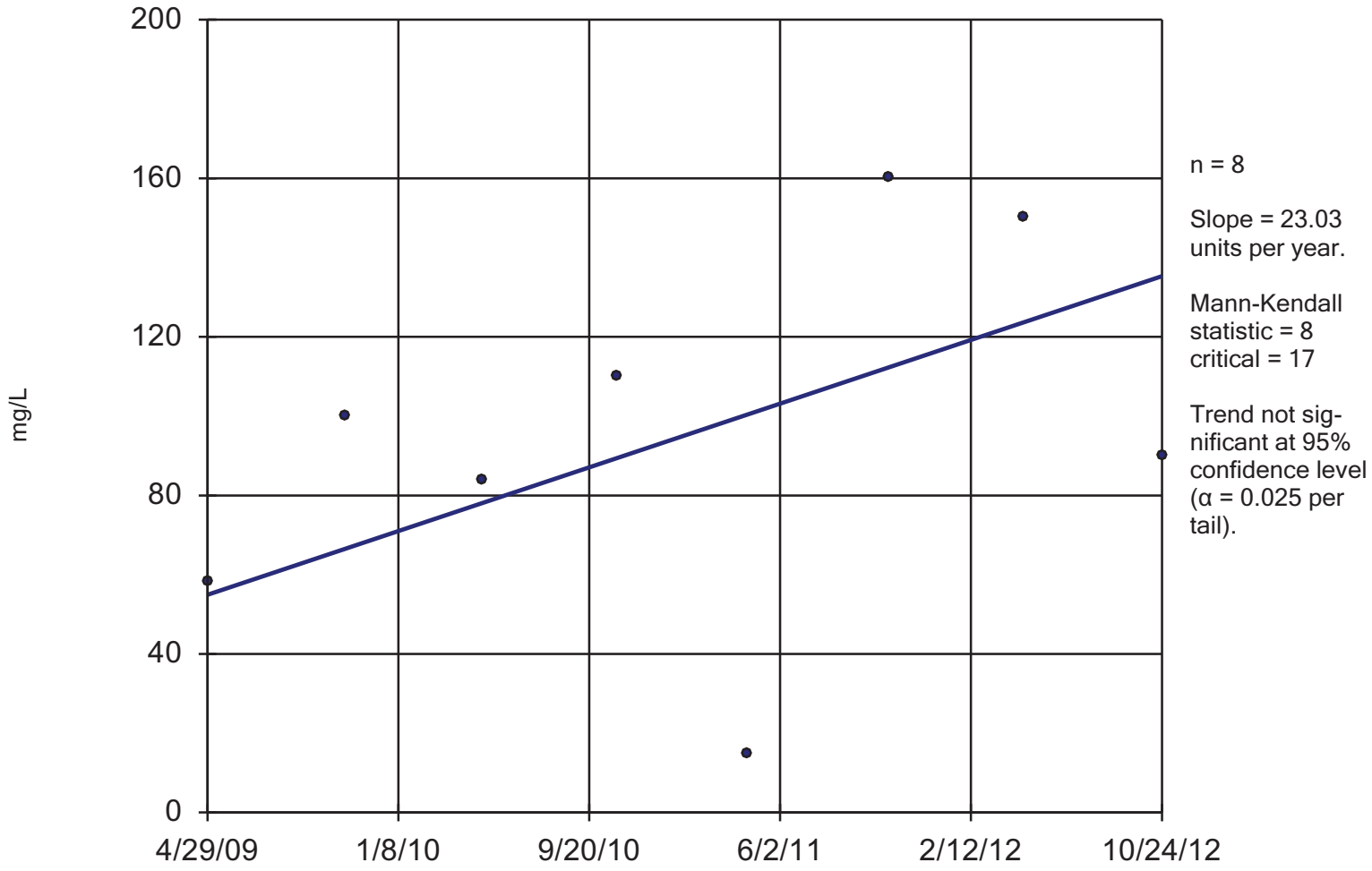



Constituent: Boron, dissolved  Analysis Run 12/14/2012 11:49 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-4



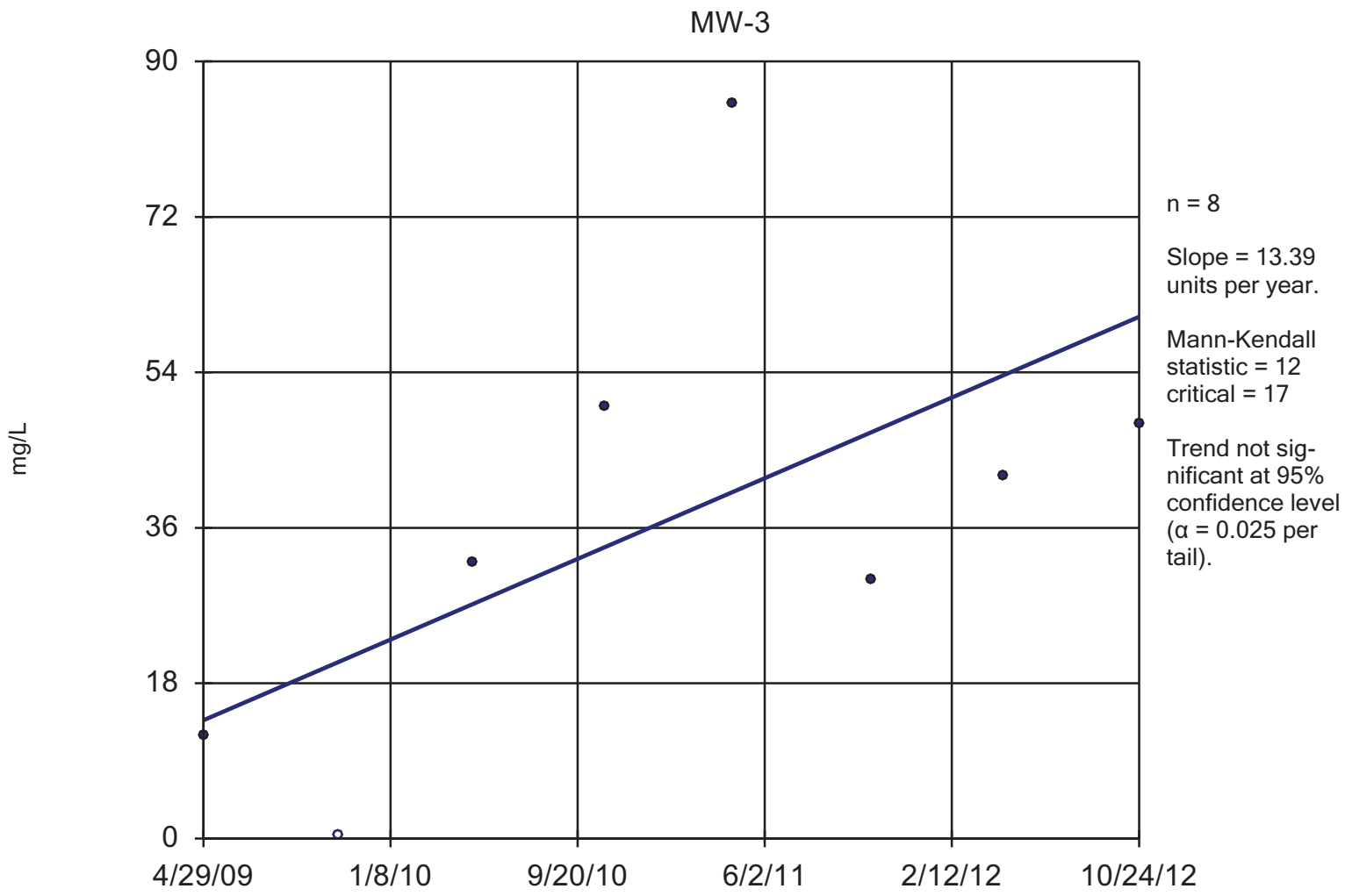

Constituent: Chloride  Analysis Run 12/14/2012 11:49 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator

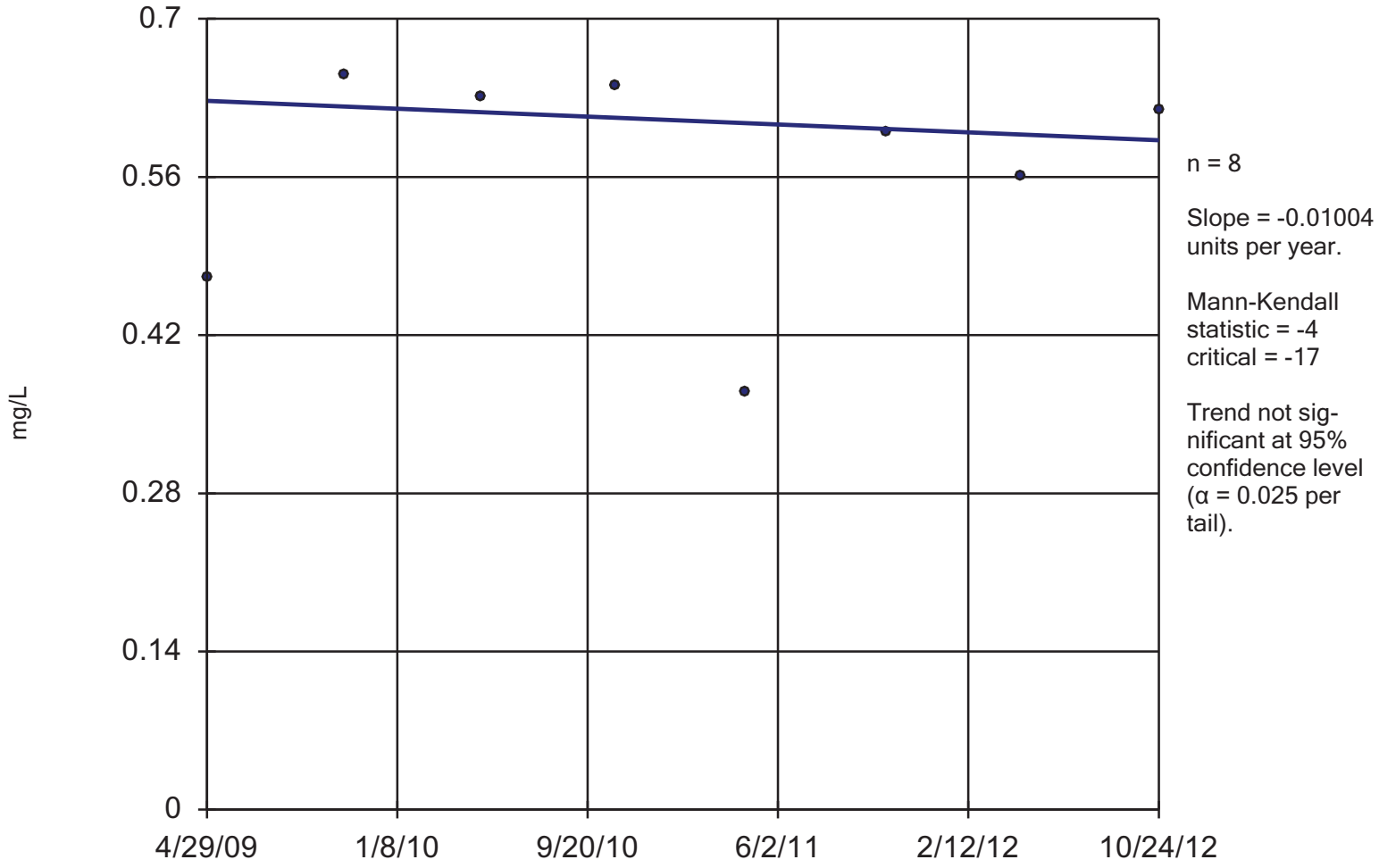



Constituent: Chloride Analysis Run 12/14/2012 11:49 AM

Facility: Yard 520 Restricted Waste Site Client: Weaver Boos Consultants Data File: Yard520 database

# Sen's Slope Estimator

## MW-4

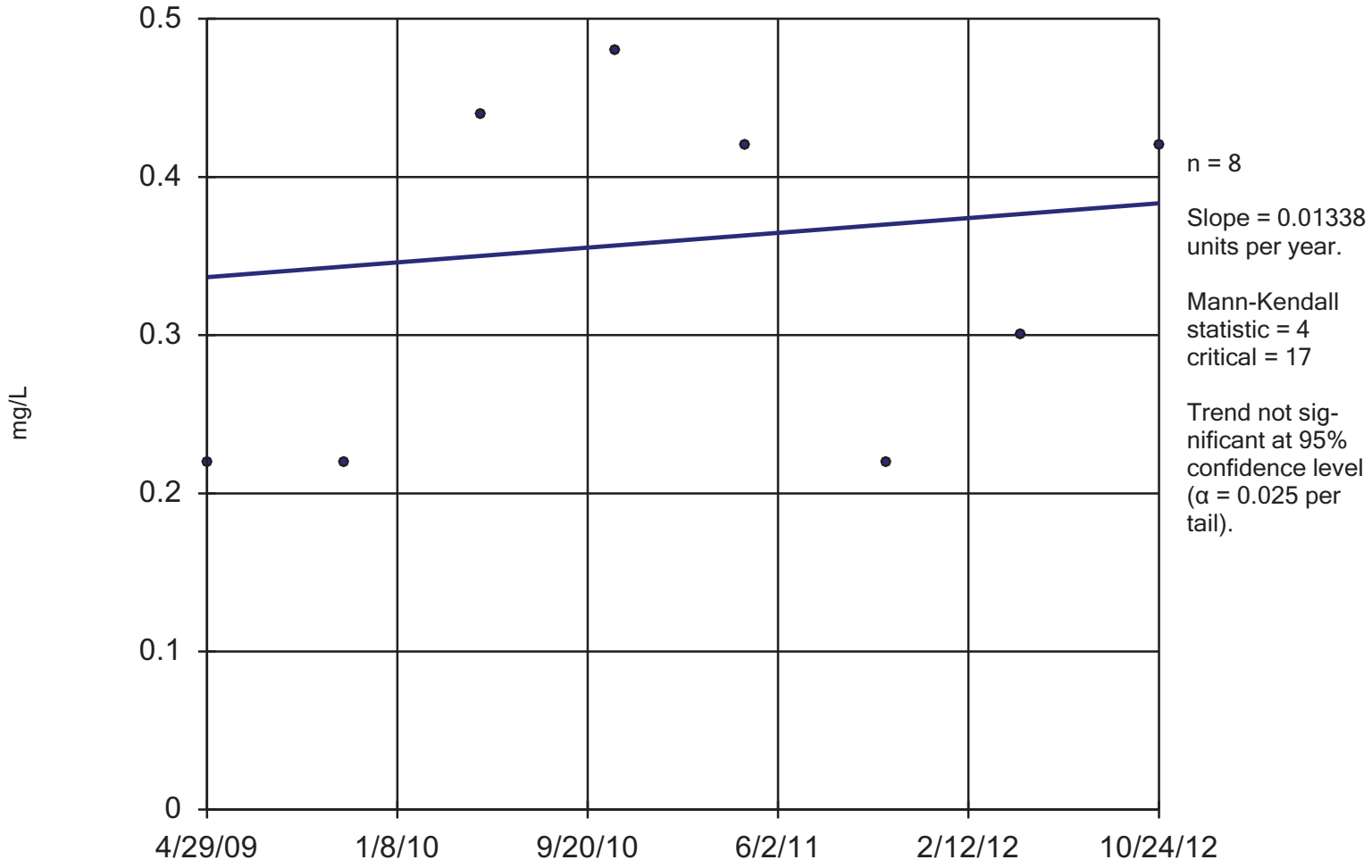



Constituent: Fluoride  Analysis Run 12/14/2012 11:49 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-3



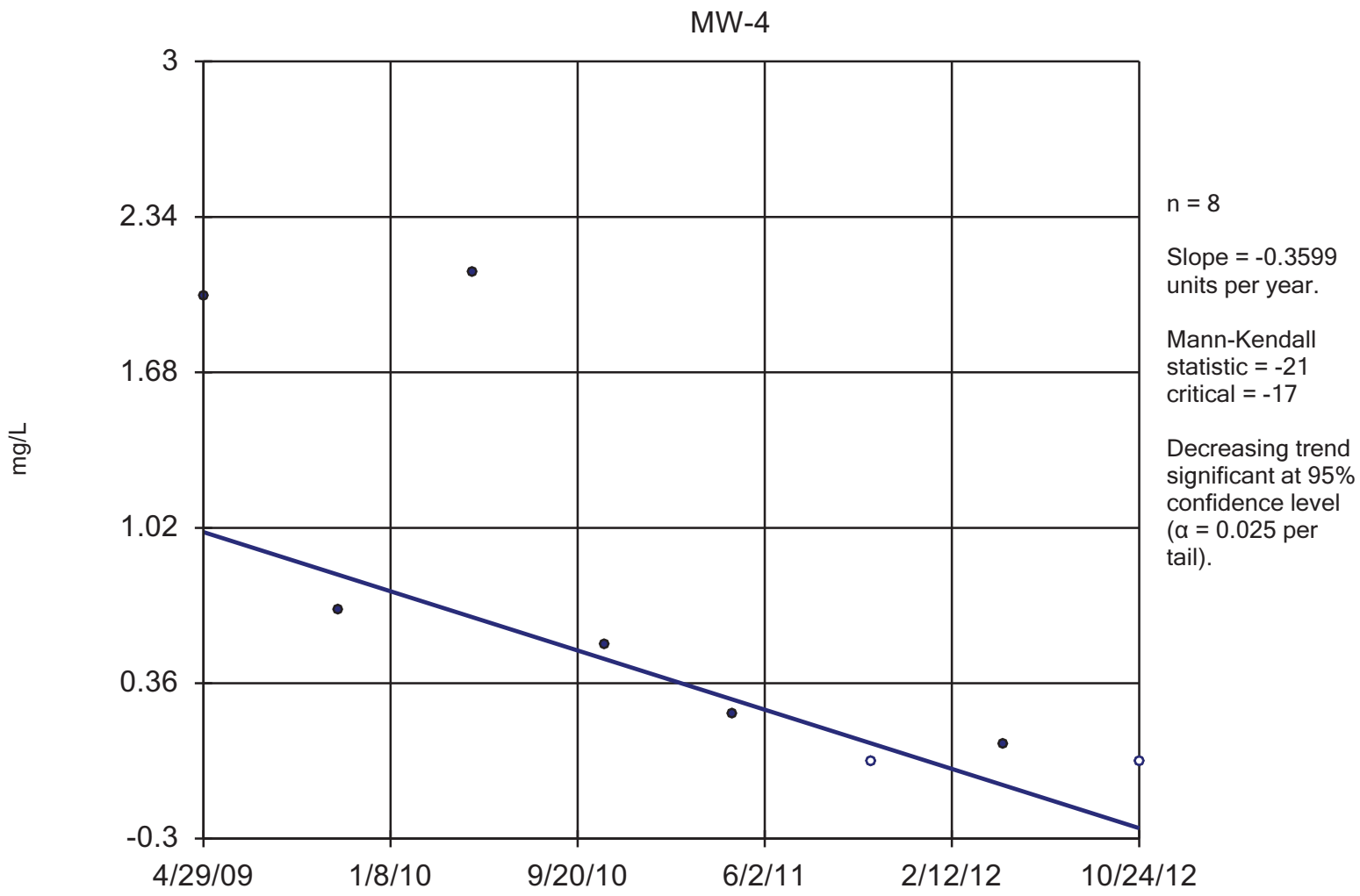

Constituent: Fluoride  Analysis Run 12/14/2012 11:49 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator



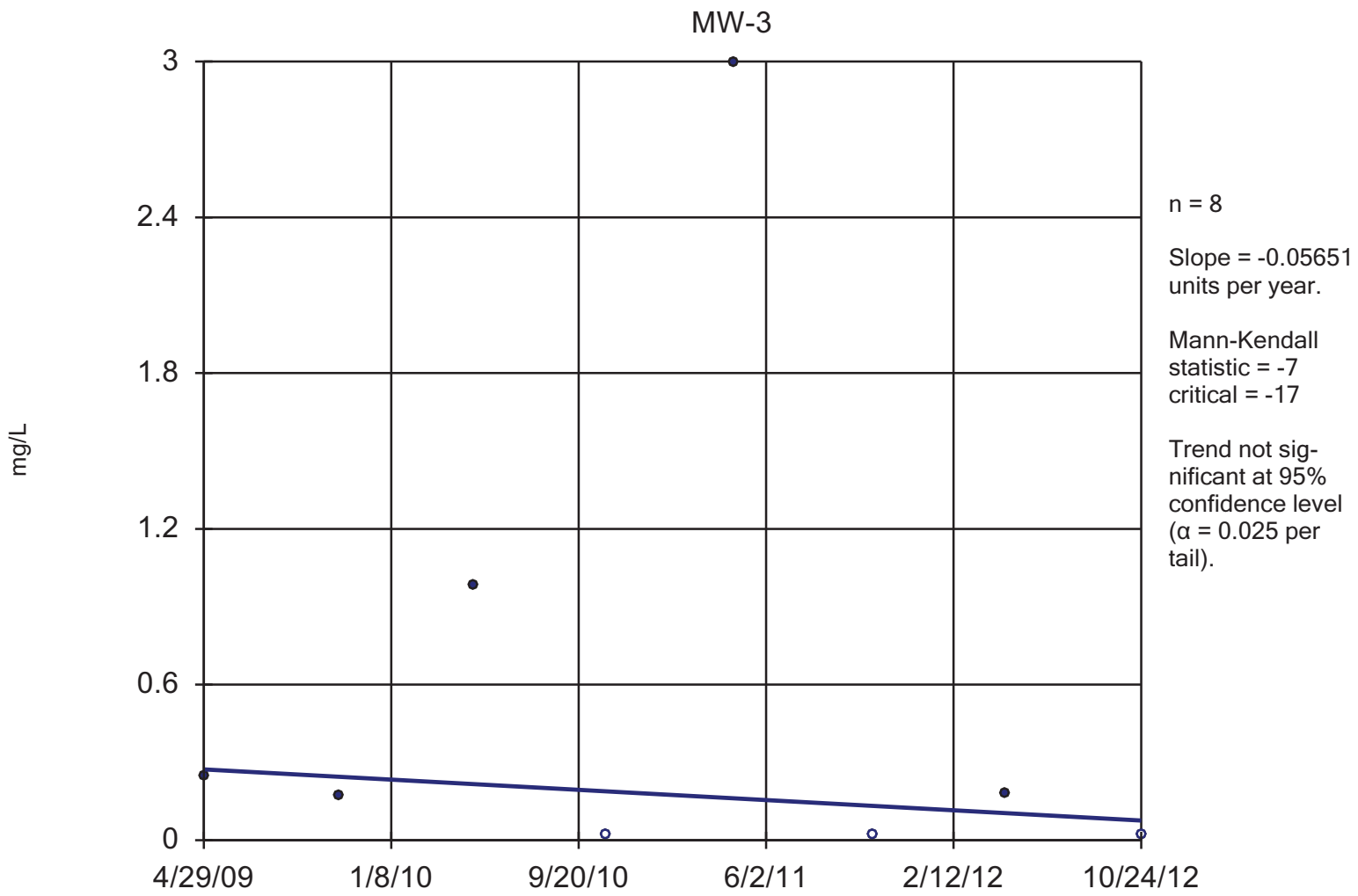

Constituent: Iron, dissolved  Analysis Run 12/14/2012 11:49 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

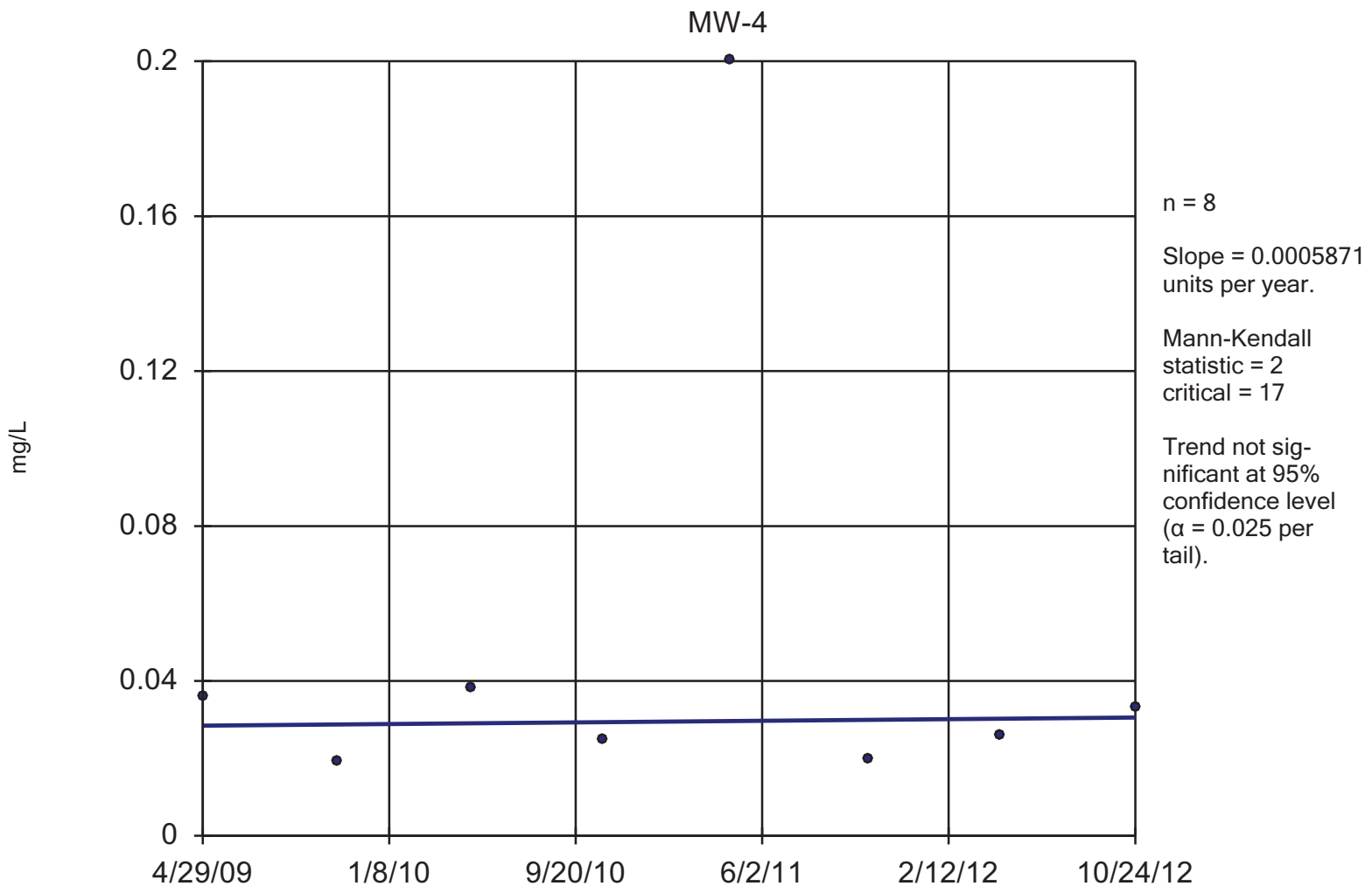
# Sen's Slope Estimator




Constituent: Iron, dissolved  Analysis Run 12/14/2012 11:49 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

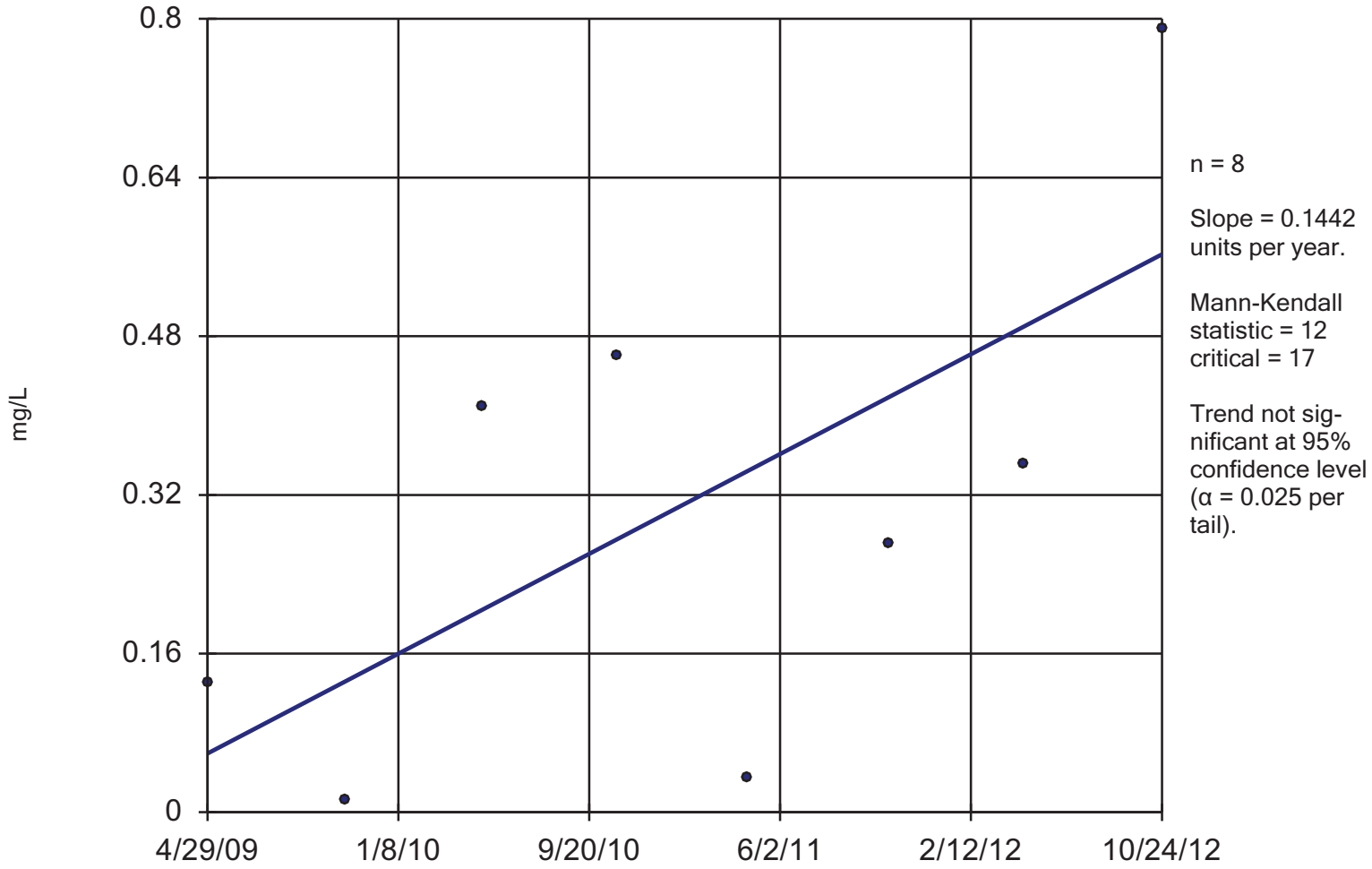



Constituent: Manganese, dissolved  Analysis Run 12/14/2012 11:49 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-3

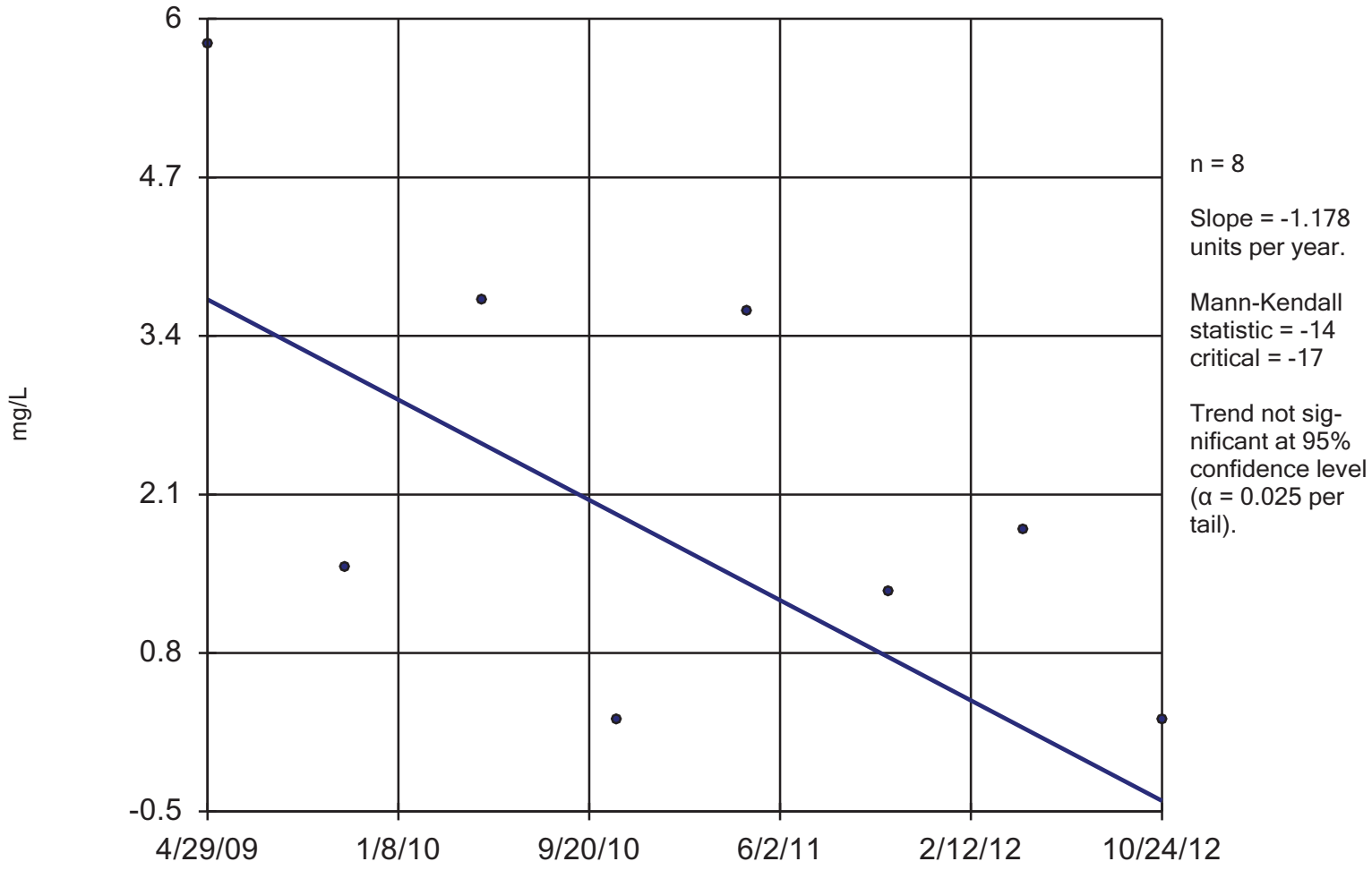



Constituent: Manganese, dissolved  Analysis Run 12/14/2012 11:49 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-4




n = 8

Slope = -1.178 units per year.

Mann-Kendall statistic = -14
critical = -17

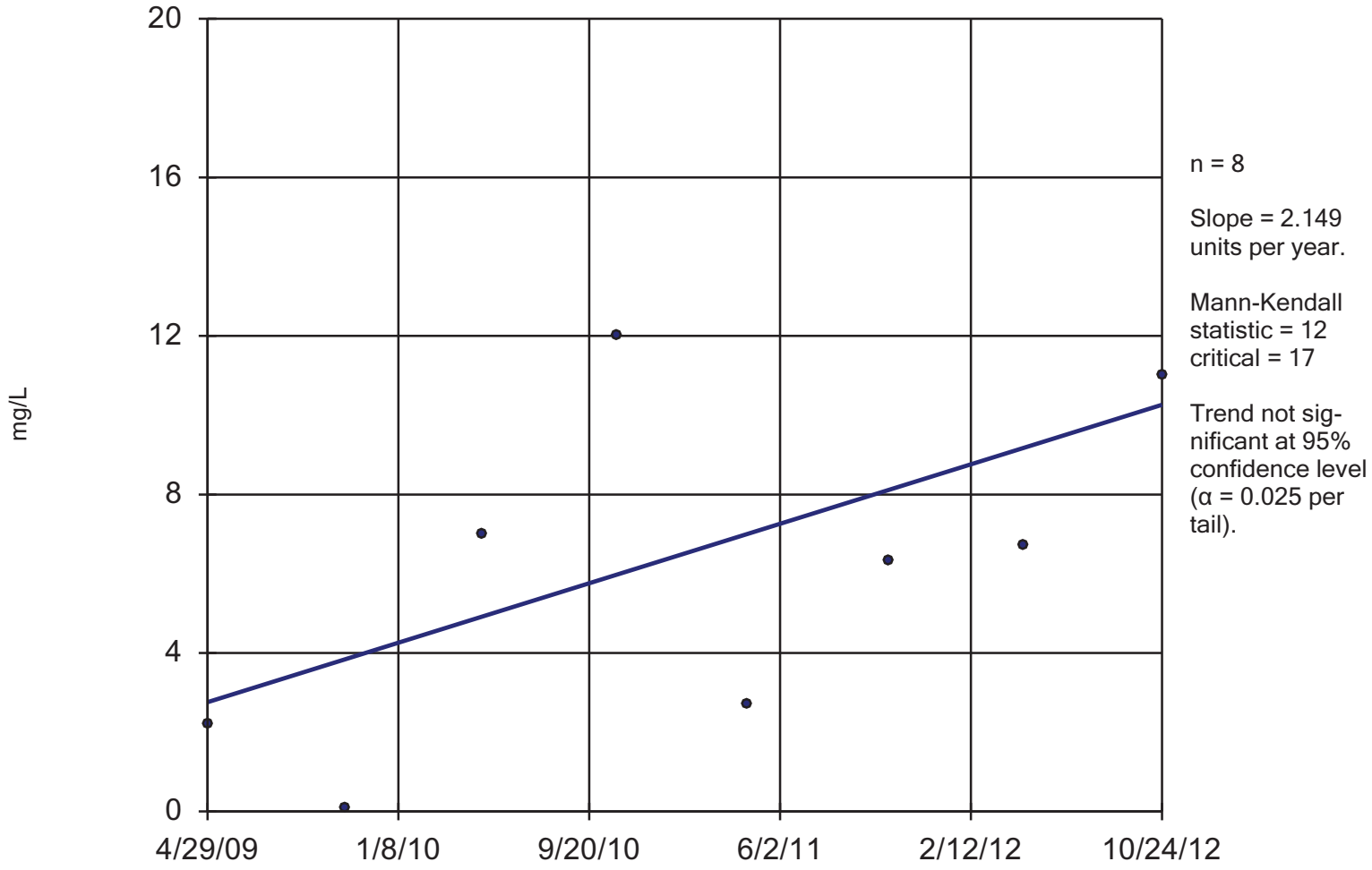
Trend not significant at 95% confidence level (α = 0.025 per tail).

Constituent: Molybdenum, dissolved  Analysis Run 12/14/2012 11:49 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-3

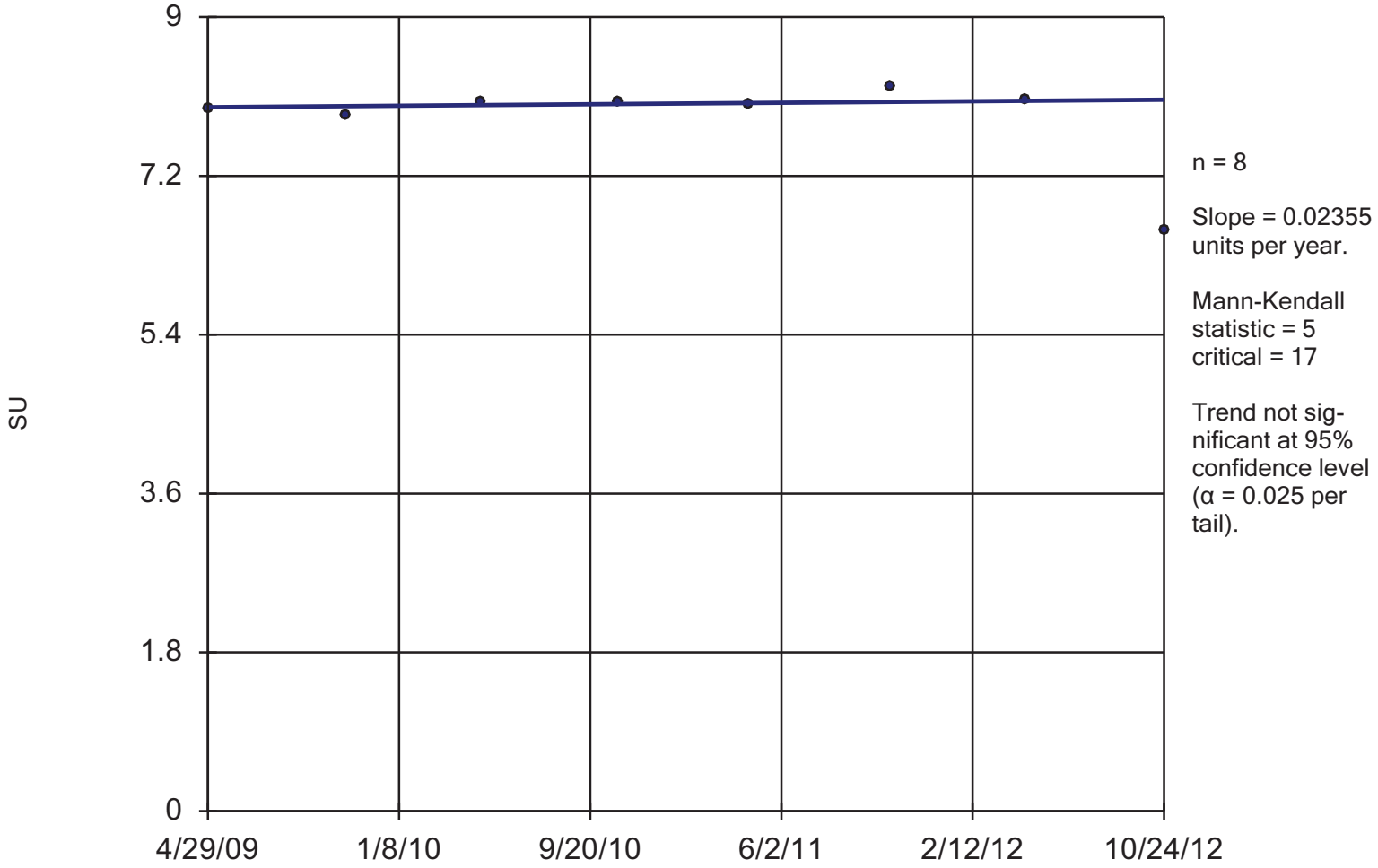



Constituent: Molybdenum, dissolved  Analysis Run 12/14/2012 11:50 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-4

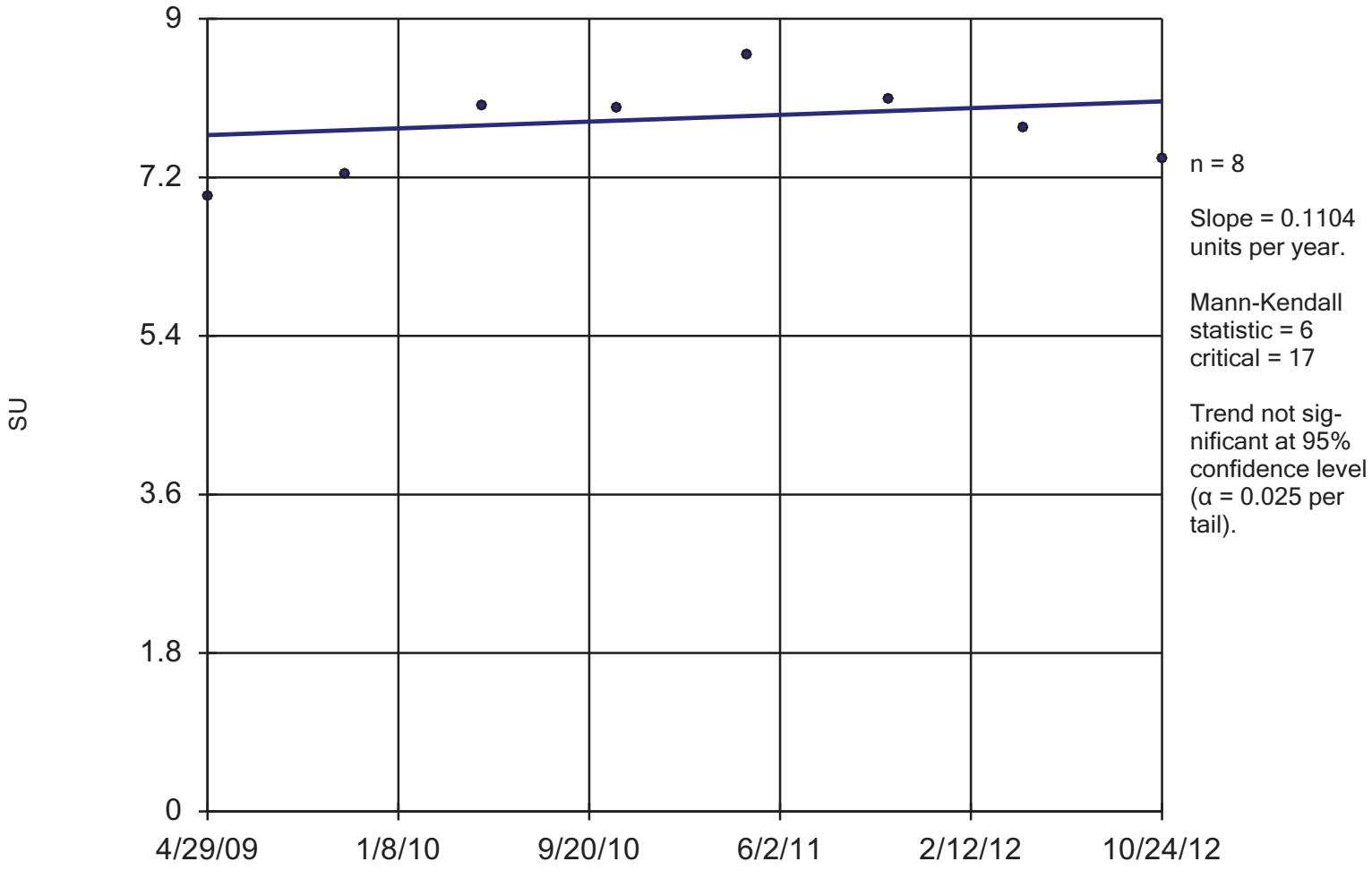



Constituent: pH, Field  Analysis Run 12/14/2012 11:50 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-3

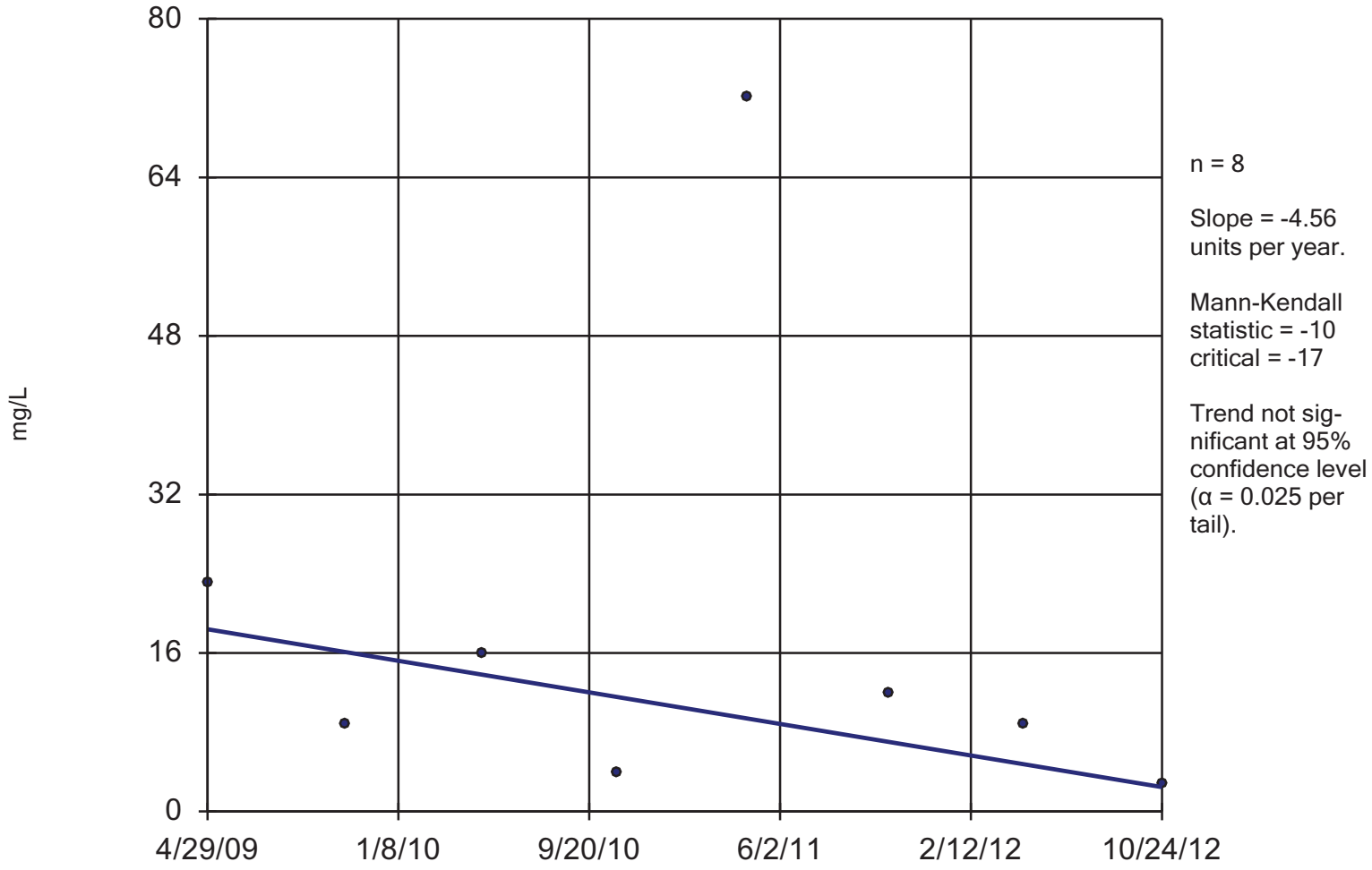



Constituent: pH, Field  Analysis Run 12/14/2012 11:50 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-4

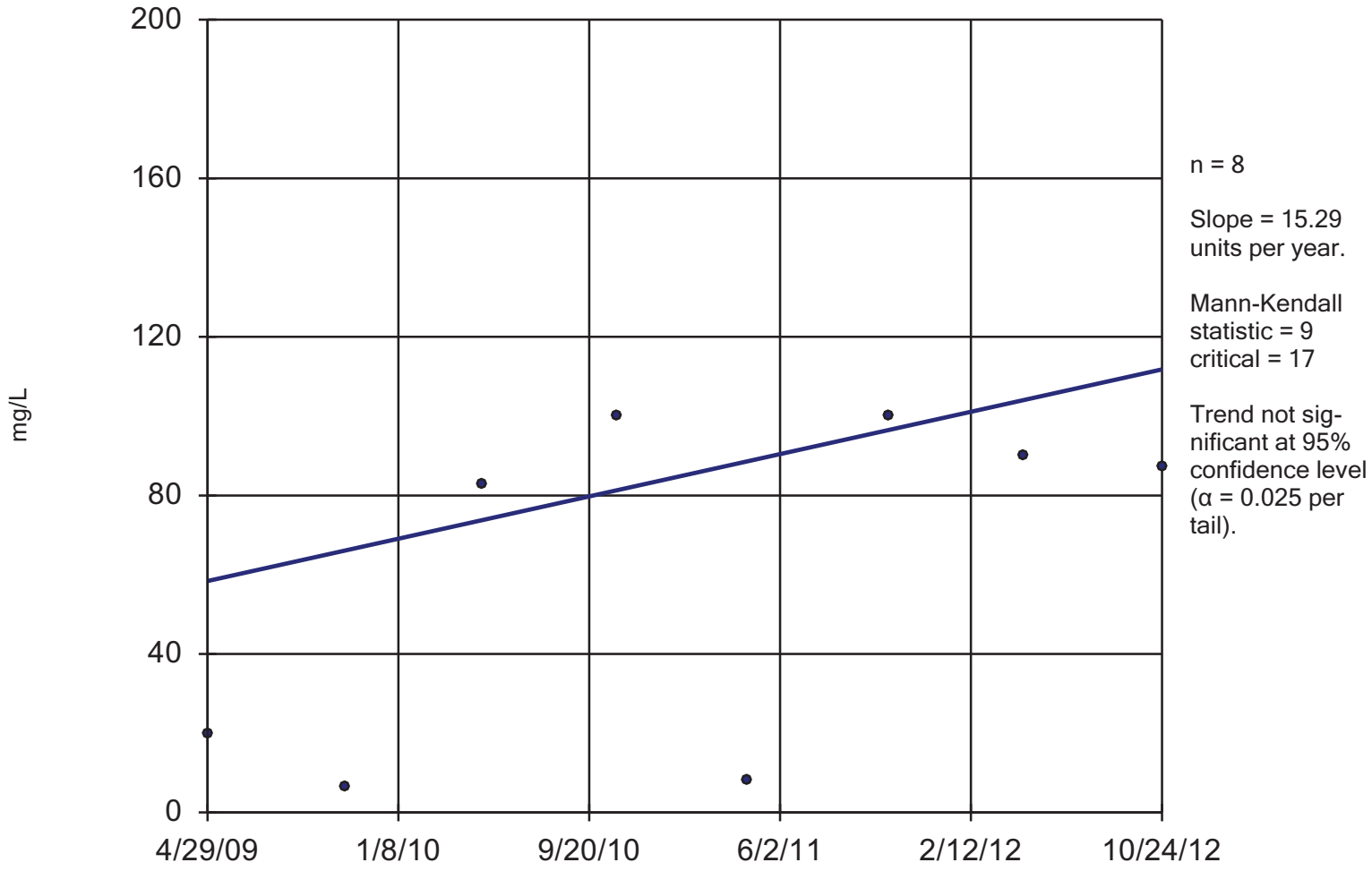



Constituent: Potassium, dissolved  Analysis Run 12/14/2012 11:50 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-3




Constituent: Potassium, dissolved  Analysis Run 12/14/2012 11:50 AM

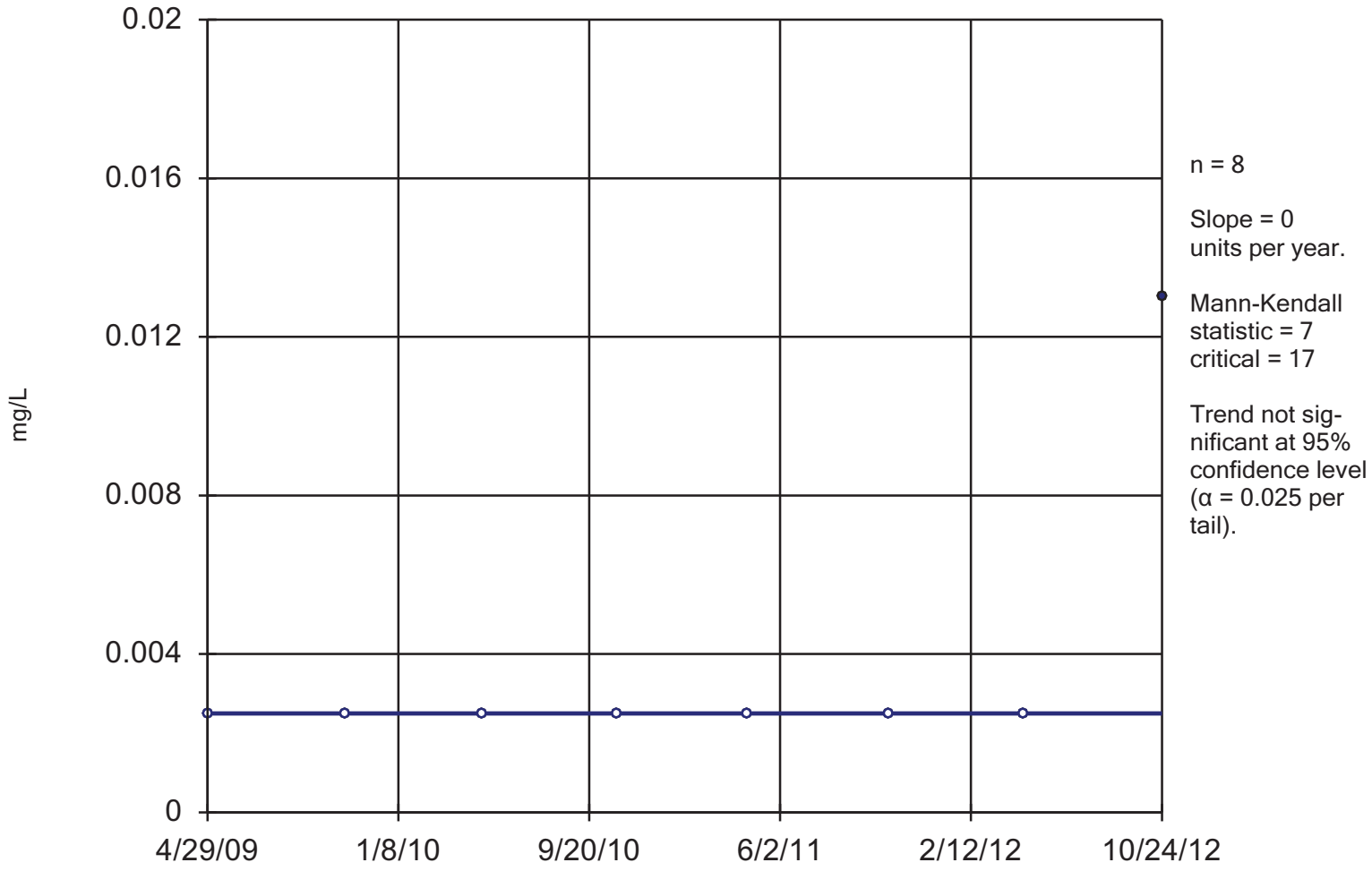
Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator

## MW-4



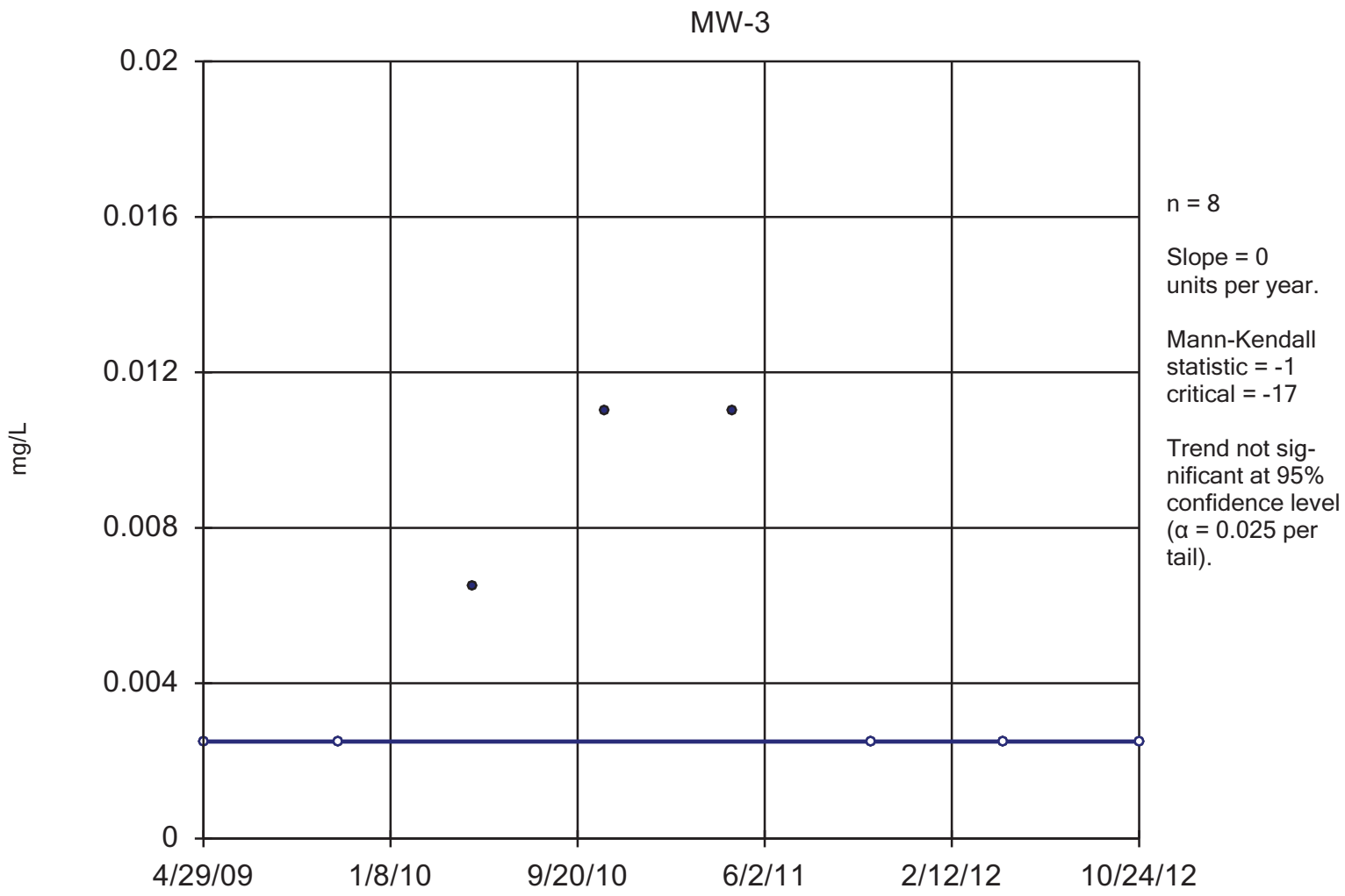

Constituent: Selenium, dissolved  Analysis Run 12/14/2012 11:50 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator

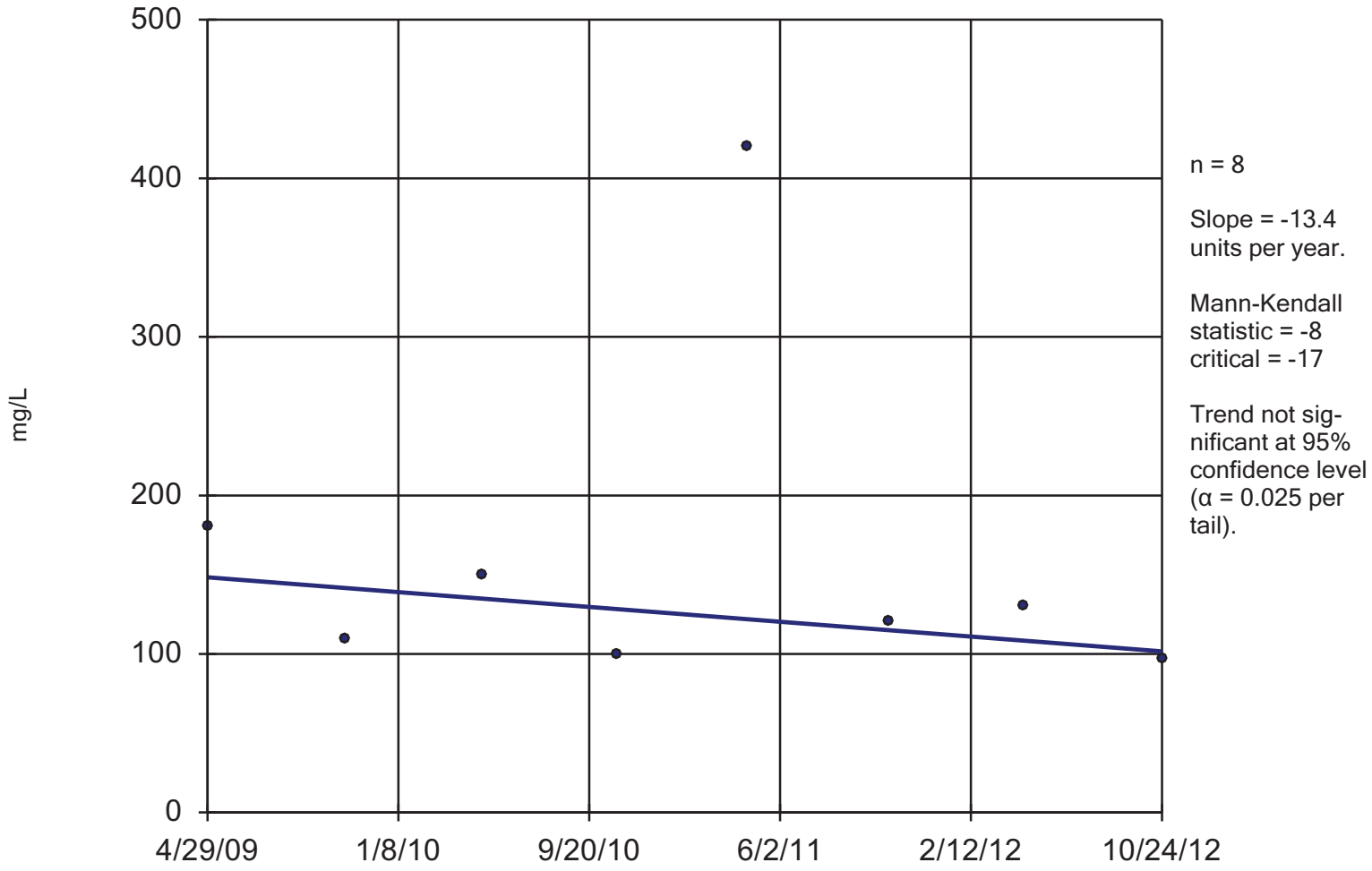



Constituent: Selenium, dissolved  Analysis Run 12/14/2012 11:50 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-4

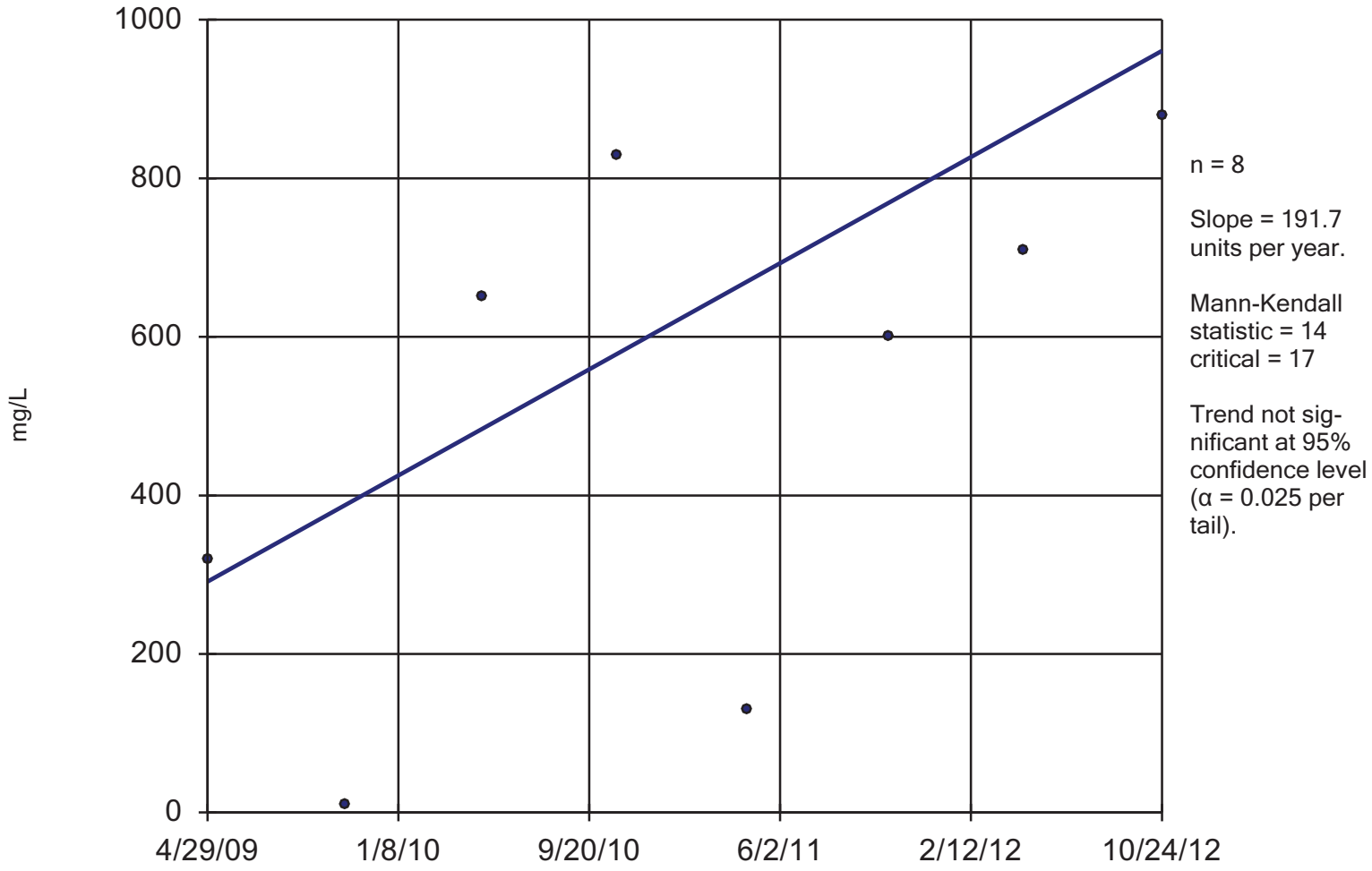



Constituent: Sodium, dissolved  Analysis Run 12/14/2012 11:50 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-3

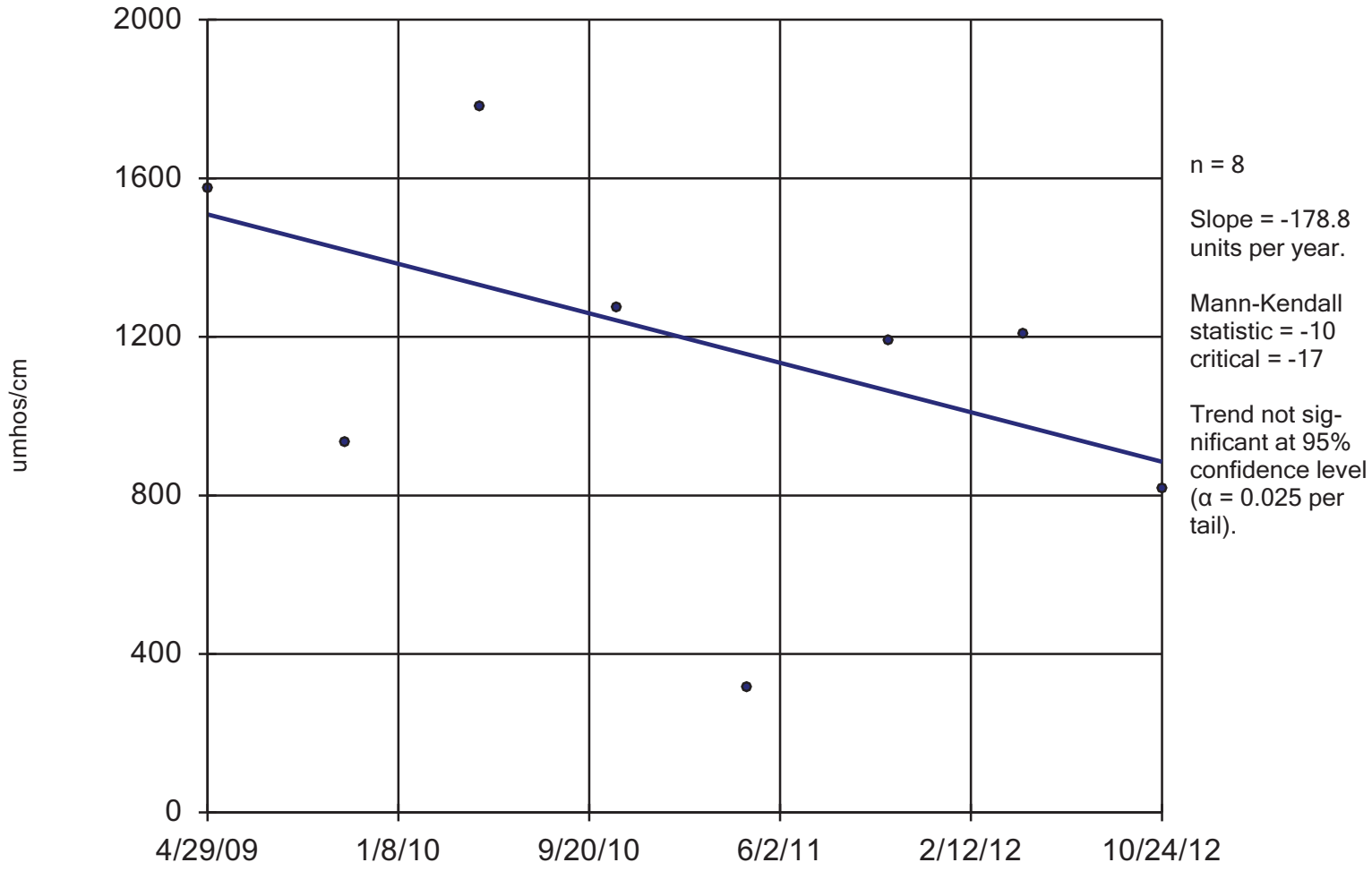



Constituent: Sodium, dissolved  Analysis Run 12/14/2012 11:50 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-4




n = 8

Slope = -178.8 units per year.

Mann-Kendall statistic = -10
critical = -17

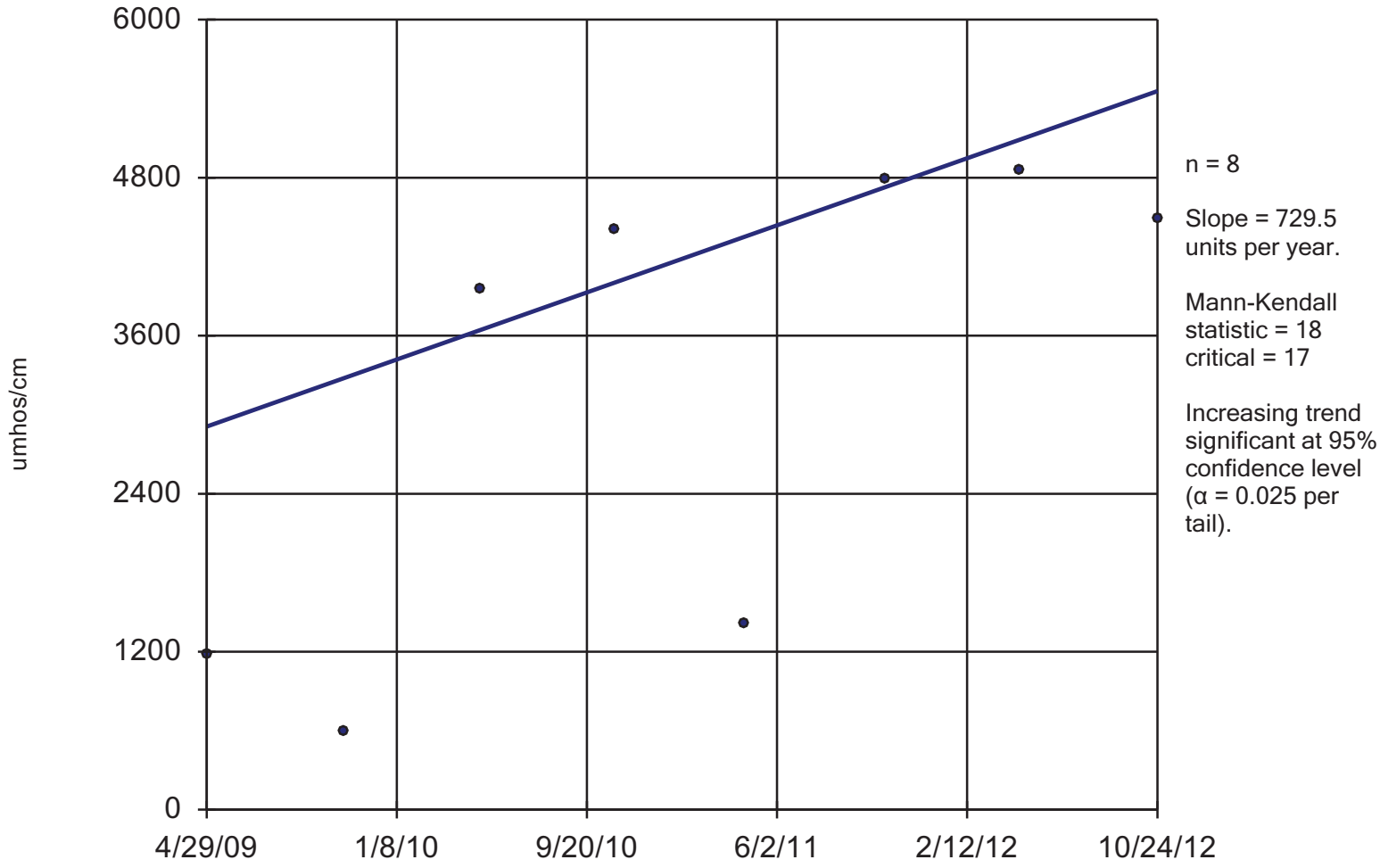
Trend not significant at 95% confidence level (α = 0.025 per tail).

Constituent: Specific Conductivity, Field  Analysis Run 12/14/2012 11:50 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-3



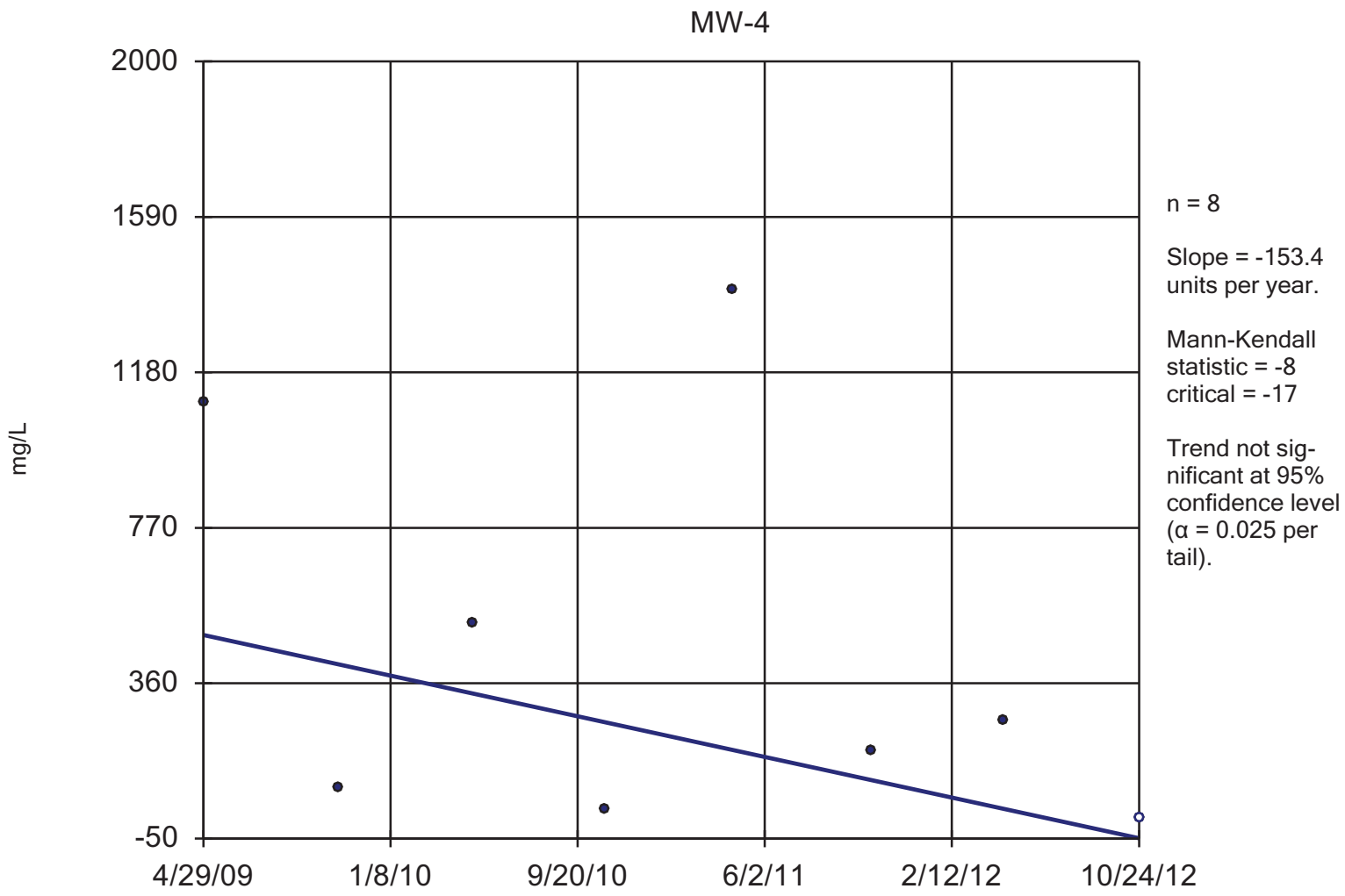

Constituent: Specific Conductivity, Field  Analysis Run 12/14/2012 11:50 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator

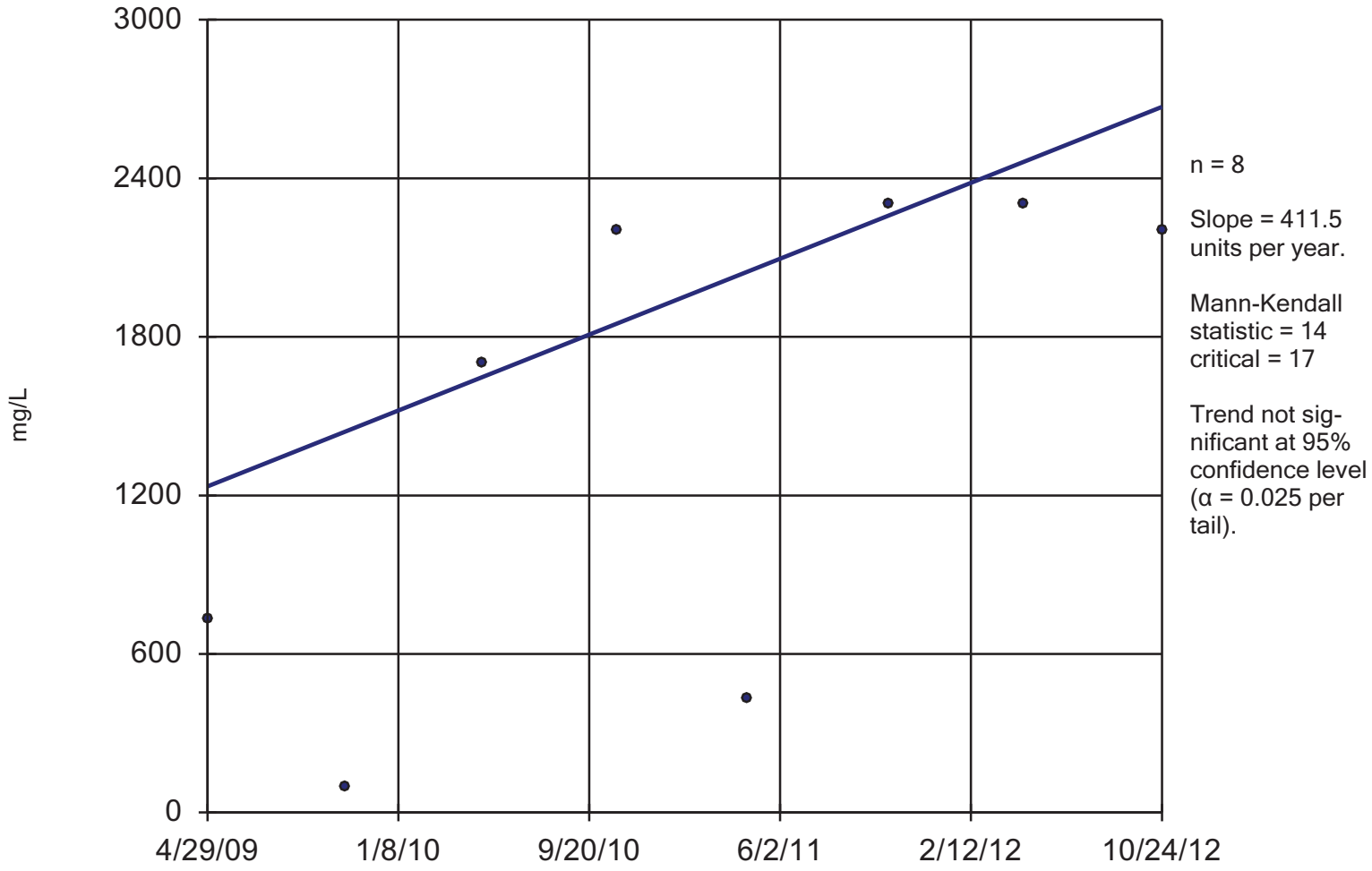



Constituent: Sulfate, total  Analysis Run 12/14/2012 11:50 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-3

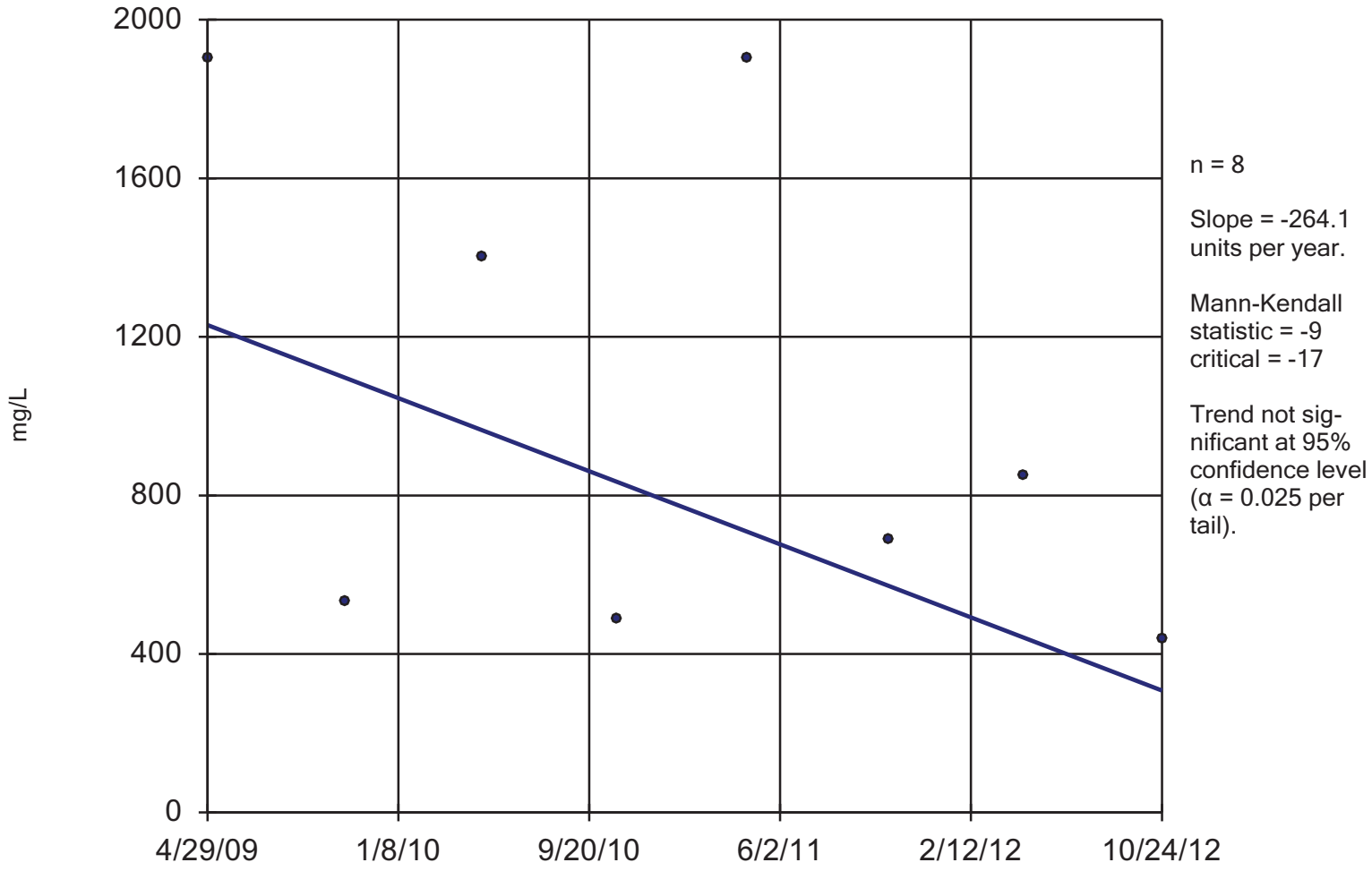



Constituent: Sulfate, total  Analysis Run 12/14/2012 11:50 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-4

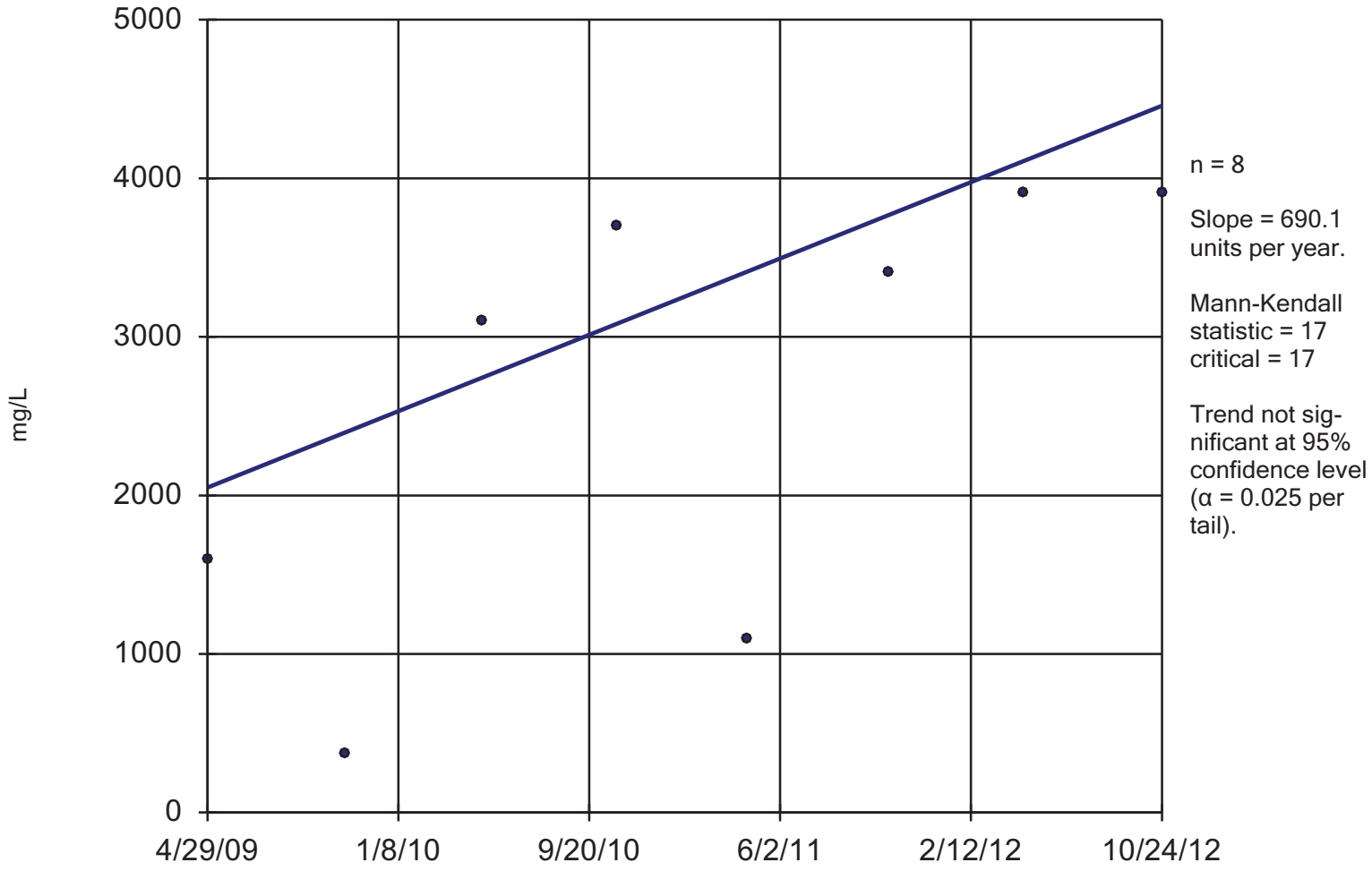



Constituent: Total Dissolved Solids  Analysis Run 12/14/2012 11:50 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-3



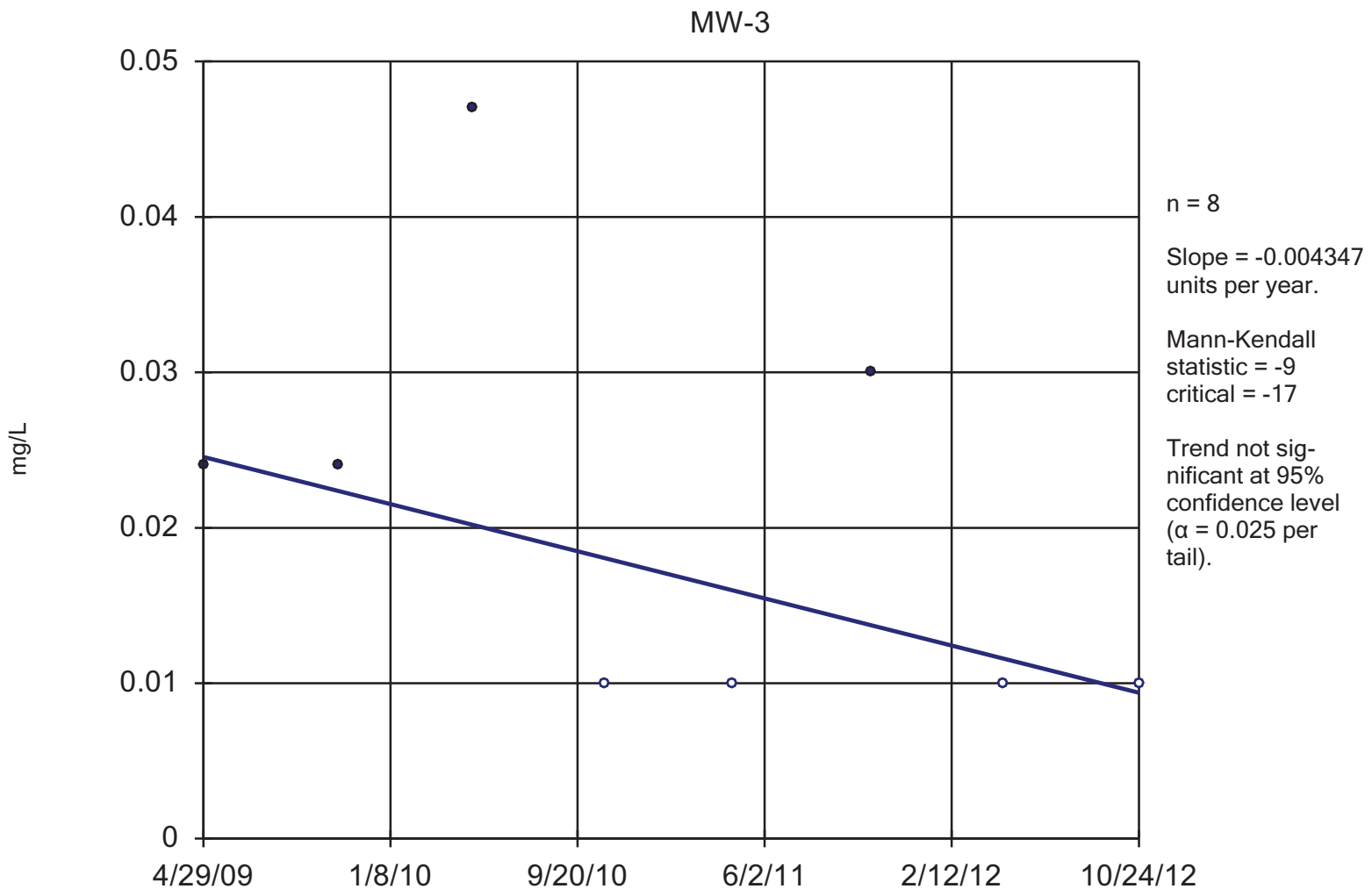

Constituent: Total Dissolved Solids  Analysis Run 12/14/2012 11:50 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator




Constituent: Zinc, dissolved  Analysis Run 12/14/2012 11:50 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope/Mann-Kendall

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database  Printed 12/14/2012, 9:28 AM

| Constituent | Well | Slope | Mann-K. | Critical | Sig. | N | Alpha |
|---|---|---|---|---|---|---|---|
| Arsenic, dissolved (mg/L) | MW-6 | -0.05638 | -12 | -17 | No | 8 | 0.05 |
| Barium, dissolved (mg/L) | MW-10 | 0.01156 | 7 | 17 | No | 8 | 0.05 |
| Barium, dissolved (mg/L) | MW-11 | -0.00... | -2 | -17 | No | 8 | 0.05 |
| Barium, dissolved (mg/L) | MW-8 | 0.03743 | 17 | 17 | No | 8 | 0.05 |
| Barium, dissolved (mg/L) | MW-13D (bg) | 0 | 0 | 17 | No | 8 | 0.05 |
| **Barium, dissolved (mg/L)** | **MW-13S (bg)** | **0.02049** | **23** | **17** | **Yes** | **8** | **0.05** |
| Barium, dissolved (mg/L) | MW-14D (bg) | 0.0179 | 13 | 17 | No | 8 | 0.05 |
| Barium, dissolved (mg/L) | MW-14S (bg) | -0.00... | -1 | -17 | No | 8 | 0.05 |
| Barium, dissolved (mg/L) | MW-1R (bg) | -0.04576 | -13 | -17 | No | 8 | 0.05 |
| Barium, dissolved (mg/L) | MW-6 | 0 | 1 | 17 | No | 8 | 0.05 |
| Barium, dissolved (mg/L) | MW-7 | 0.007691 | 14 | 17 | No | 8 | 0.05 |
| Boron, dissolved (mg/L) | MW-10 | -0.1679 | 0 | 17 | No | 8 | 0.05 |
| **Boron, dissolved (mg/L)** | **MW-11** | **1.241** | **21** | **17** | **Yes** | **8** | **0.05** |
| Boron, dissolved (mg/L) | MW-8 | 8.635 | 14 | 17 | No | 8 | 0.05 |
| Boron, dissolved (mg/L) | MW-13D (bg) | 0.01427 | 12 | 17 | No | 8 | 0.05 |
| **Boron, dissolved (mg/L)** | **MW-13S (bg)** | **0.07981** | **20** | **17** | **Yes** | **8** | **0.05** |
| **Boron, dissolved (mg/L)** | **MW-14D (bg)** | **0.4282** | **22** | **17** | **Yes** | **8** | **0.05** |
| **Boron, dissolved (mg/L)** | **MW-14S (bg)** | **0.9801** | **28** | **17** | **Yes** | **8** | **0.05** |
| Boron, dissolved (mg/L) | MW-1R (bg) | 0.7448 | 17 | 17 | No | 8 | 0.05 |
| Boron, dissolved (mg/L) | MW-6 | 3.694 | 14 | 17 | No | 8 | 0.05 |
| **Boron, dissolved (mg/L)** | **MW-7** | **1.169** | **21** | **17** | **Yes** | **8** | **0.05** |
| Chloride (mg/L) | MW-10 | 20.19 | 2 | 17 | No | 8 | 0.05 |
| Chloride (mg/L) | MW-11 | 71.86 | 17 | 17 | No | 8 | 0.05 |
| **Chloride (mg/L)** | **MW-8** | **17.02** | **22** | **17** | **Yes** | **8** | **0.05** |
| Chloride (mg/L) | MW-13D (bg) | 0 | 4 | 17 | No | 8 | 0.05 |
| Chloride (mg/L) | MW-13S (bg) | 179.9 | 4 | 17 | No | 8 | 0.05 |
| Chloride (mg/L) | MW-14D (bg) | -147 | -17 | -17 | No | 8 | 0.05 |
| Chloride (mg/L) | MW-14S (bg) | -97.31 | -7 | -17 | No | 8 | 0.05 |
| Chloride (mg/L) | MW-1R (bg) | -14.82 | -3 | -17 | No | 8 | 0.05 |
| Chloride (mg/L) | MW-6 | 0.4002 | 3 | 17 | No | 8 | 0.05 |
| Chloride (mg/L) | MW-7 | 0 | -1 | -17 | No | 8 | 0.05 |
| Fluoride (mg/L) | MW-10 | -0.00... | -1 | -17 | No | 8 | 0.05 |
| Fluoride (mg/L) | MW-11 | 0 | 0 | 17 | No | 8 | 0.05 |
| Fluoride (mg/L) | MW-8 | -0.00... | 0 | 17 | No | 8 | 0.05 |
| Fluoride (mg/L) | MW-13D (bg) | 0 | 0 | 17 | No | 8 | 0.05 |
| Fluoride (mg/L) | MW-13S (bg) | 0 | -1 | -17 | No | 8 | 0.05 |
| Fluoride (mg/L) | MW-14D (bg) | 0 | 5 | 17 | No | 8 | 0.05 |
| Fluoride (mg/L) | MW-14S (bg) | -0.0216 | -7 | -17 | No | 8 | 0.05 |
| Fluoride (mg/L) | MW-1R (bg) | 0 | 7 | 17 | No | 8 | 0.05 |
| **Fluoride (mg/L)** | **MW-7** | **0.02007** | **23** | **17** | **Yes** | **8** | **0.05** |
| **Iron, dissolved (mg/L)** | **MW-10** | **-0.09042** | **-18** | **-17** | **Yes** | **8** | **0.05** |
| Iron, dissolved (mg/L) | MW-11 | -0.902 | -7 | -17 | No | 8 | 0.05 |
| Iron, dissolved (mg/L) | MW-8 | 1.029 | 12 | 17 | No | 8 | 0.05 |
| Iron, dissolved (mg/L) | MW-13D (bg) | -1.518 | -13 | -17 | No | 8 | 0.05 |
| Iron, dissolved (mg/L) | MW-14D (bg) | 0.1663 | 5 | 17 | No | 8 | 0.05 |
| Iron, dissolved (mg/L) | MW-14S (bg) | -0.01777 | -9 | -17 | No | 8 | 0.05 |
| Iron, dissolved (mg/L) | MW-1R (bg) | 4.434 | 16 | 17 | No | 8 | 0.05 |
| Iron, dissolved (mg/L) | MW-6 | -0.7918 | -5 | -17 | No | 8 | 0.05 |
| **Iron, dissolved (mg/L)** | **MW-7** | **3.758** | **23** | **17** | **Yes** | **8** | **0.05** |
| Manganese, dissolved (mg/L) | MW-10 | -0.01242 | -9 | -17 | No | 8 | 0.05 |

# Sen's Slope/Mann-Kendall

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database  Printed 12/14/2012, 9:28 AM

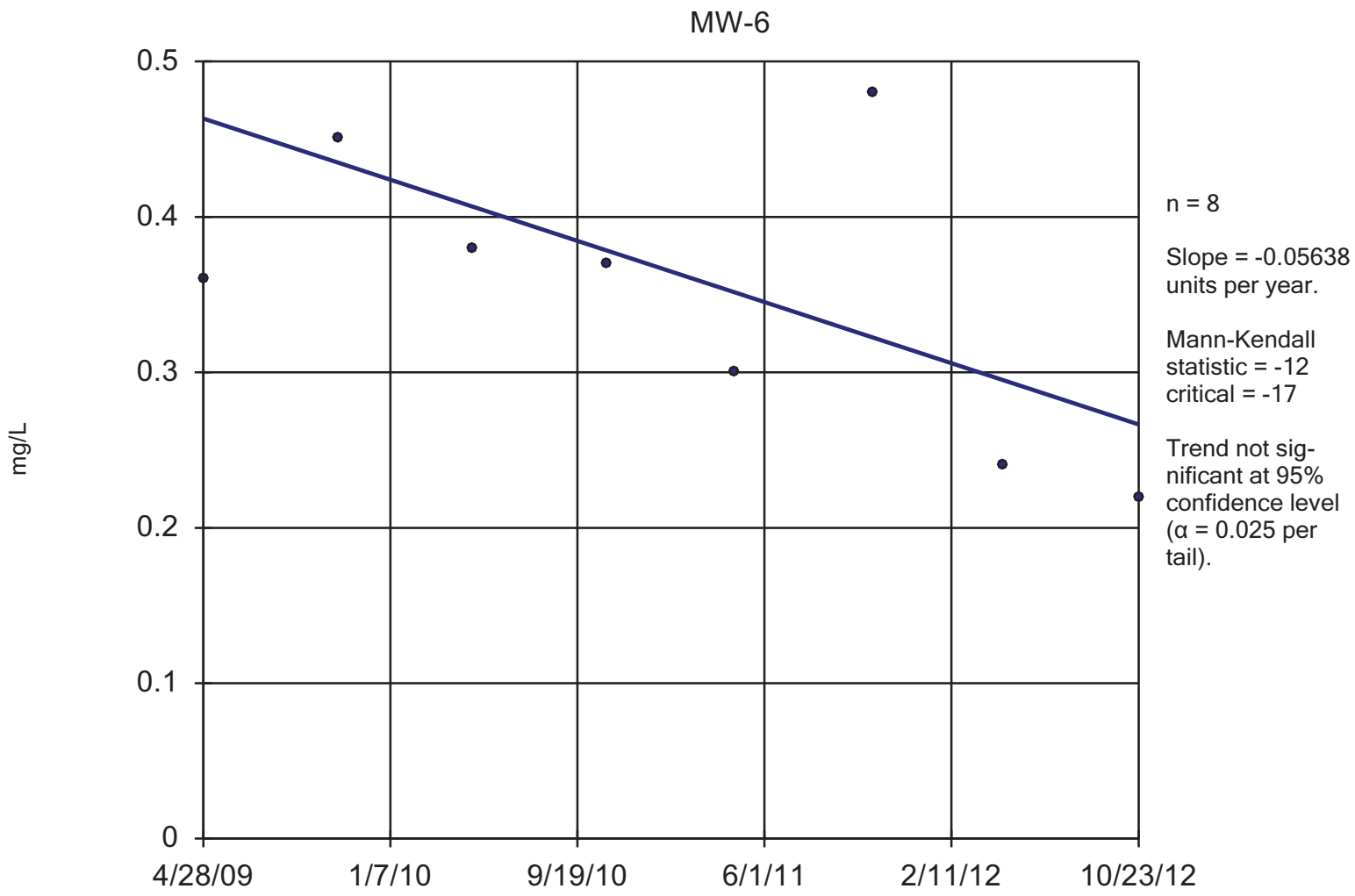
| Constituent | Well | Slope | Mann-K. | Critical | Sig. | N | Alpha |
|---|---|---|---|---|---|---|---|
| **Manganese, dissolved (mg/L)** | **MW-11** | **-0.03119** | **-18** | **-17** | **Yes** | **8** | **0.05** |
| Manganese, dissolved (mg/L) | MW-8 | 0.15 | 16 | 17 | No | 8 | 0.05 |
| Manganese, dissolved (mg/L) | MW-13D (bg) | 0 | 2 | 17 | No | 8 | 0.05 |
| **Manganese, dissolved (mg/L)** | **MW-13S (bg)** | **0.05022** | **22** | **17** | **Yes** | **8** | **0.05** |
| **Manganese, dissolved (mg/L)** | **MW-14D (bg)** | **0.0377** | **19** | **17** | **Yes** | **8** | **0.05** |
| Manganese, dissolved (mg/L) | MW-14S (bg) | 0.001371 | 8 | 17 | No | 8 | 0.05 |
| **Manganese, dissolved (mg/L)** | **MW-1R (bg)** | **0.398** | **18** | **17** | **Yes** | **8** | **0.05** |
| Manganese, dissolved (mg/L) | MW-6 | -0.02431 | -10 | -17 | No | 8 | 0.05 |
| Manganese, dissolved (mg/L) | MW-7 | -0.01674 | -4 | -17 | No | 8 | 0.05 |
| Molybdenum, dissolved (mg/L) | MW-10 | -1.069 | -15 | -17 | No | 8 | 0.05 |
| Molybdenum, dissolved (mg/L) | MW-8 | -0.01058 | -14 | -17 | No | 8 | 0.05 |
| Molybdenum, dissolved (mg/L) | MW-14S (bg) | 0.003355 | 16 | 17 | No | 8 | 0.05 |
| Molybdenum, dissolved (mg/L) | MW-1R (bg) | 0.000... | 1 | 17 | No | 8 | 0.05 |
| **Molybdenum, dissolved (mg/L)** | **MW-6** | **0.1616** | **23** | **17** | **Yes** | **8** | **0.05** |
| Molybdenum, dissolved (mg/L) | MW-7 | 0.007234 | 4 | 17 | No | 8 | 0.05 |
| pH, Field (SU) | MW-10 | -0.09894 | -6 | -17 | No | 8 | 0.05 |
| pH, Field (SU) | MW-11 | -0.00... | 0 | 17 | No | 8 | 0.05 |
| pH, Field (SU) | MW-8 | -0.03093 | -2 | -17 | No | 8 | 0.05 |
| pH, Field (SU) | MW-13D (bg) | -0.05168 | -10 | -17 | No | 8 | 0.05 |
| **pH, Field (SU)** | **MW-13S (bg)** | **-0.1989** | **-20** | **-17** | **Yes** | **8** | **0.05** |
| pH, Field (SU) | MW-14D (bg) | -0.158 | -10 | -17 | No | 8 | 0.05 |
| pH, Field (SU) | MW-14S (bg) | -0.00... | 0 | 17 | No | 8 | 0.05 |
| pH, Field (SU) | MW-1R (bg) | -0.06661 | -8 | -17 | No | 8 | 0.05 |
| pH, Field (SU) | MW-6 | -0.02884 | -11 | -17 | No | 8 | 0.05 |
| pH, Field (SU) | MW-7 | 0.0207 | 3 | 17 | No | 8 | 0.05 |
| Potassium, dissolved (mg/L) | MW-10 | 2.298 | 12 | 17 | No | 8 | 0.05 |
| Potassium, dissolved (mg/L) | MW-11 | -0.133 | -14 | -17 | No | 8 | 0.05 |
| Potassium, dissolved (mg/L) | MW-8 | 6.855 | 14 | 17 | No | 8 | 0.05 |
| Potassium, dissolved (mg/L) | MW-13D (bg) | -0.1593 | -7 | -17 | No | 8 | 0.05 |
| **Potassium, dissolved (mg/L)** | **MW-13S (bg)** | **1.178** | **26** | **17** | **Yes** | **8** | **0.05** |
| Potassium, dissolved (mg/L) | MW-14D (bg) | -0.168 | -8 | -17 | No | 8 | 0.05 |
| Potassium, dissolved (mg/L) | MW-14S (bg) | 0.5629 | 14 | 17 | No | 8 | 0.05 |
| Potassium, dissolved (mg/L) | MW-1R (bg) | 0.6518 | 6 | 17 | No | 8 | 0.05 |
| Potassium, dissolved (mg/L) | MW-6 | 3 | 17 | 17 | No | 8 | 0.05 |
| **Potassium, dissolved (mg/L)** | **MW-7** | **1.151** | **21** | **17** | **Yes** | **8** | **0.05** |
| Sodium, dissolved (mg/L) | MW-10 | 33.46 | 15 | 17 | No | 8 | 0.05 |
| Sodium, dissolved (mg/L) | MW-11 | -6.526 | -3 | -17 | No | 8 | 0.05 |
| Sodium, dissolved (mg/L) | MW-8 | 11.23 | 14 | 17 | No | 8 | 0.05 |
| Sodium, dissolved (mg/L) | MW-13D (bg) | 0 | 4 | 17 | No | 8 | 0.05 |
| Sodium, dissolved (mg/L) | MW-13S (bg) | 35.62 | 4 | 17 | No | 8 | 0.05 |
| **Sodium, dissolved (mg/L)** | **MW-14D (bg)** | **-103.8** | **-22** | **-17** | **Yes** | **8** | **0.05** |
| Sodium, dissolved (mg/L) | MW-14S (bg) | -145.8 | -14 | -17 | No | 8 | 0.05 |
| Sodium, dissolved (mg/L) | MW-1R (bg) | -256.9 | -16 | -17 | No | 8 | 0.05 |
| Sodium, dissolved (mg/L) | MW-6 | 3.475 | 15 | 17 | No | 8 | 0.05 |
| Sodium, dissolved (mg/L) | MW-7 | 1.273 | 14 | 17 | No | 8 | 0.05 |
| Specific Conductivity, Field (u... | MW-10 | 201.2 | 12 | 17 | No | 8 | 0.05 |
| Specific Conductivity, Field (u... | MW-11 | 196.4 | 10 | 17 | No | 8 | 0.05 |
| Specific Conductivity, Field (u... | MW-8 | 240 | 12 | 17 | No | 8 | 0.05 |
| Specific Conductivity, Field (u... | MW-13D (bg) | 315.2 | 2 | 17 | No | 8 | 0.05 |
| Specific Conductivity, Field (u... | MW-13S (bg) | 611.2 | 8 | 17 | No | 8 | 0.05 |

# Sen's Slope/Mann-Kendall

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database  Printed 12/14/2012, 9:28 AM

| Constituent | Well | Slope | Mann-K. | Critical | Sig. | N | Alpha |
|---|---|---|---|---|---|---|---|
| Specific Conductivity, Field (u... | MW-14D (bg) | -304.2 | -8 | -17 | No | 8 | 0.05 |
| Specific Conductivity, Field (u... | MW-14S (bg) | -334.2 | -6 | -17 | No | 8 | 0.05 |
| Specific Conductivity, Field (u... | MW-1R (bg) | -585.4 | -12 | -17 | No | 8 | 0.05 |
| Specific Conductivity, Field (u... | MW-6 | -25.23 | -2 | -17 | No | 8 | 0.05 |
| Specific Conductivity, Field (u... | MW-7 | 129.9 | 10 | 17 | No | 8 | 0.05 |
| Sulfate, total (mg/L) | MW-10 | 113.9 | 4 | 17 | No | 8 | 0.05 |
| Sulfate, total (mg/L) | MW-11 | -15.03 | -9 | -17 | No | 8 | 0.05 |
| Sulfate, total (mg/L) | MW-8 | 85.33 | 16 | 17 | No | 8 | 0.05 |
| Sulfate, total (mg/L) | MW-13D (bg) | 7.879 | 9 | 17 | No | 8 | 0.05 |
| Sulfate, total (mg/L) | MW-13S (bg) | 10.76 | 4 | 17 | No | 8 | 0.05 |
| **Sulfate, total (mg/L)** | **MW-14D (bg)** | **19.88** | **23** | **17** | **Yes** | **8** | **0.05** |
| Sulfate, total (mg/L) | MW-14S (bg) | 55.44 | 17 | 17 | No | 8 | 0.05 |
| Sulfate, total (mg/L) | MW-1R (bg) | -14.77 | -9 | -17 | No | 8 | 0.05 |
| Sulfate, total (mg/L) | MW-6 | -216.6 | -10 | -17 | No | 8 | 0.05 |
| Sulfate, total (mg/L) | MW-7 | -36.63 | -14 | -17 | No | 8 | 0.05 |
| Total Dissolved Solids (mg/L) | MW-10 | 116.4 | 10 | 17 | No | 8 | 0.05 |
| **Total Dissolved Solids (mg/L)** | **MW-11** | **66.79** | **18** | **17** | **Yes** | **8** | **0.05** |
| Total Dissolved Solids (mg/L) | MW-8 | 183.9 | 15 | 17 | No | 8 | 0.05 |
| Total Dissolved Solids (mg/L) | MW-13D (bg) | 101.2 | 9 | 17 | No | 8 | 0.05 |
| Total Dissolved Solids (mg/L) | MW-13S (bg) | 292.2 | 8 | 17 | No | 8 | 0.05 |
| Total Dissolved Solids (mg/L) | MW-14D (bg) | -200.3 | -16 | -17 | No | 8 | 0.05 |
| Total Dissolved Solids (mg/L) | MW-14S (bg) | -202.5 | -9 | -17 | No | 8 | 0.05 |
| Total Dissolved Solids (mg/L) | MW-1R (bg) | -628.9 | -13 | -17 | No | 8 | 0.05 |
| Total Dissolved Solids (mg/L) | MW-6 | -83 | -15 | -17 | No | 8 | 0.05 |
| Total Dissolved Solids (mg/L) | MW-7 | 19.83 | 5 | 17 | No | 8 | 0.05 |

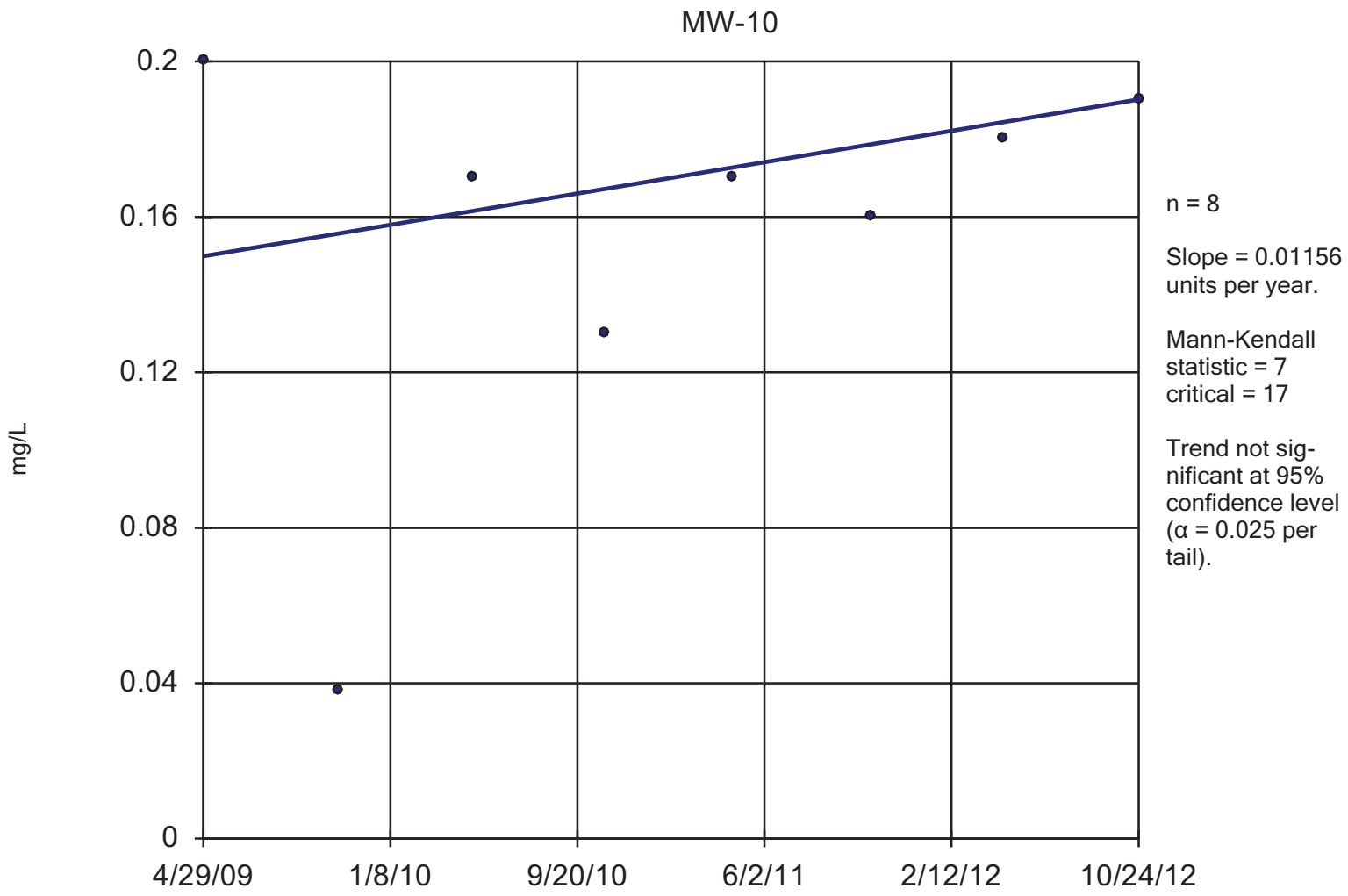
# Sen's Slope Estimator




Constituent: Arsenic, dissolved  Analysis Run 12/14/2012 9:25 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

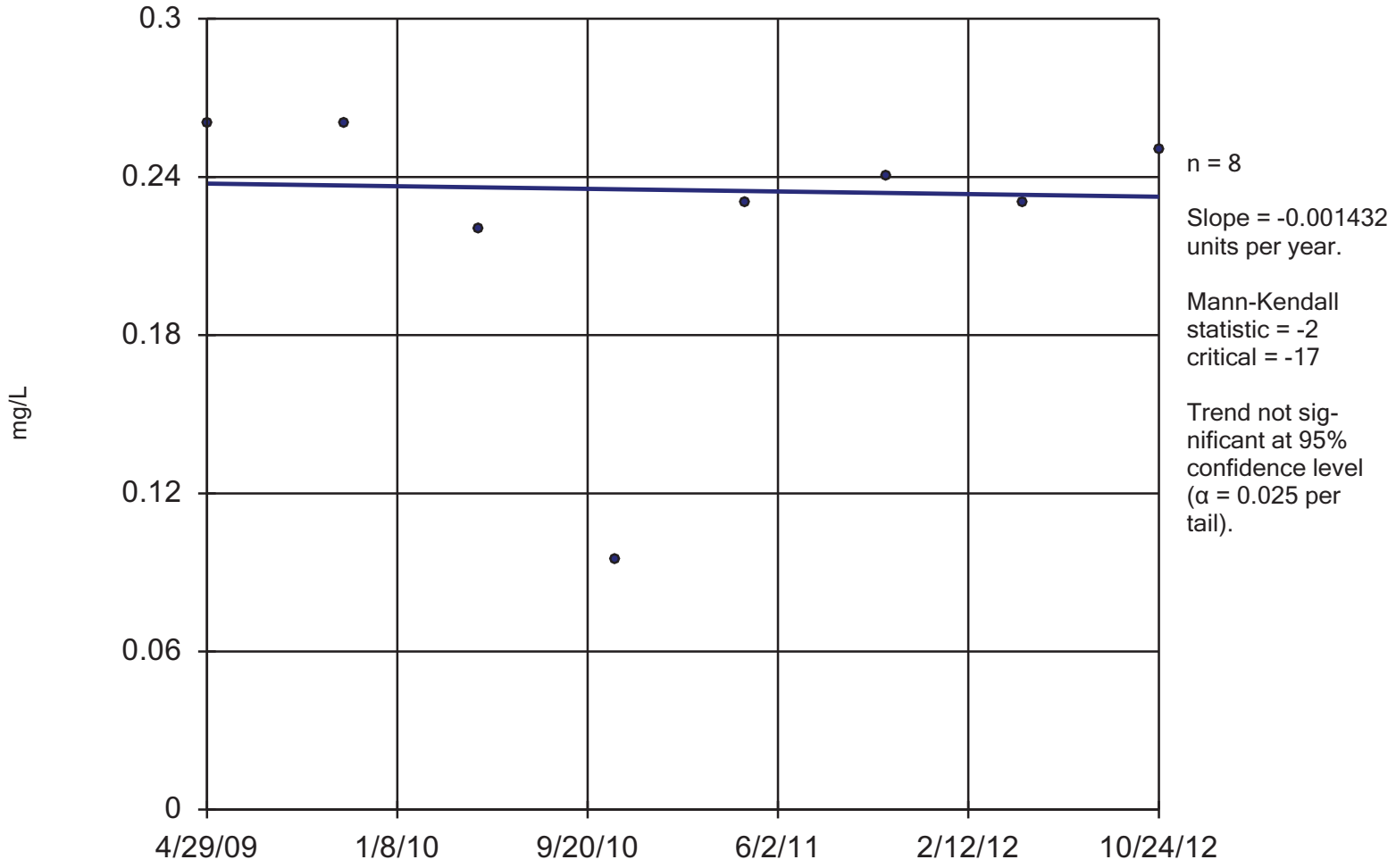



Constituent: Barium, dissolved  Analysis Run 12/14/2012 9:25 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-11

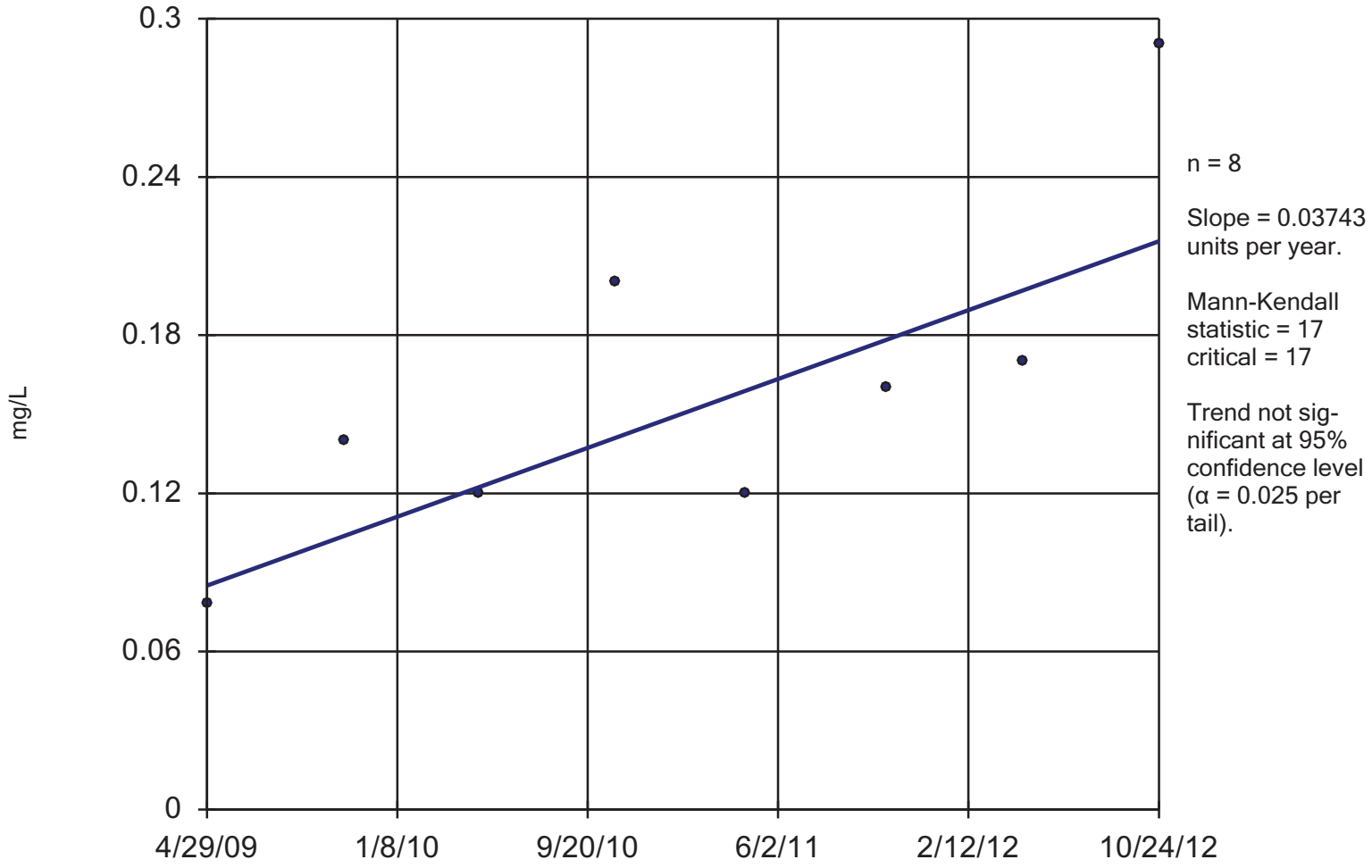



Constituent: Barium, dissolved  Analysis Run 12/14/2012 9:25 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

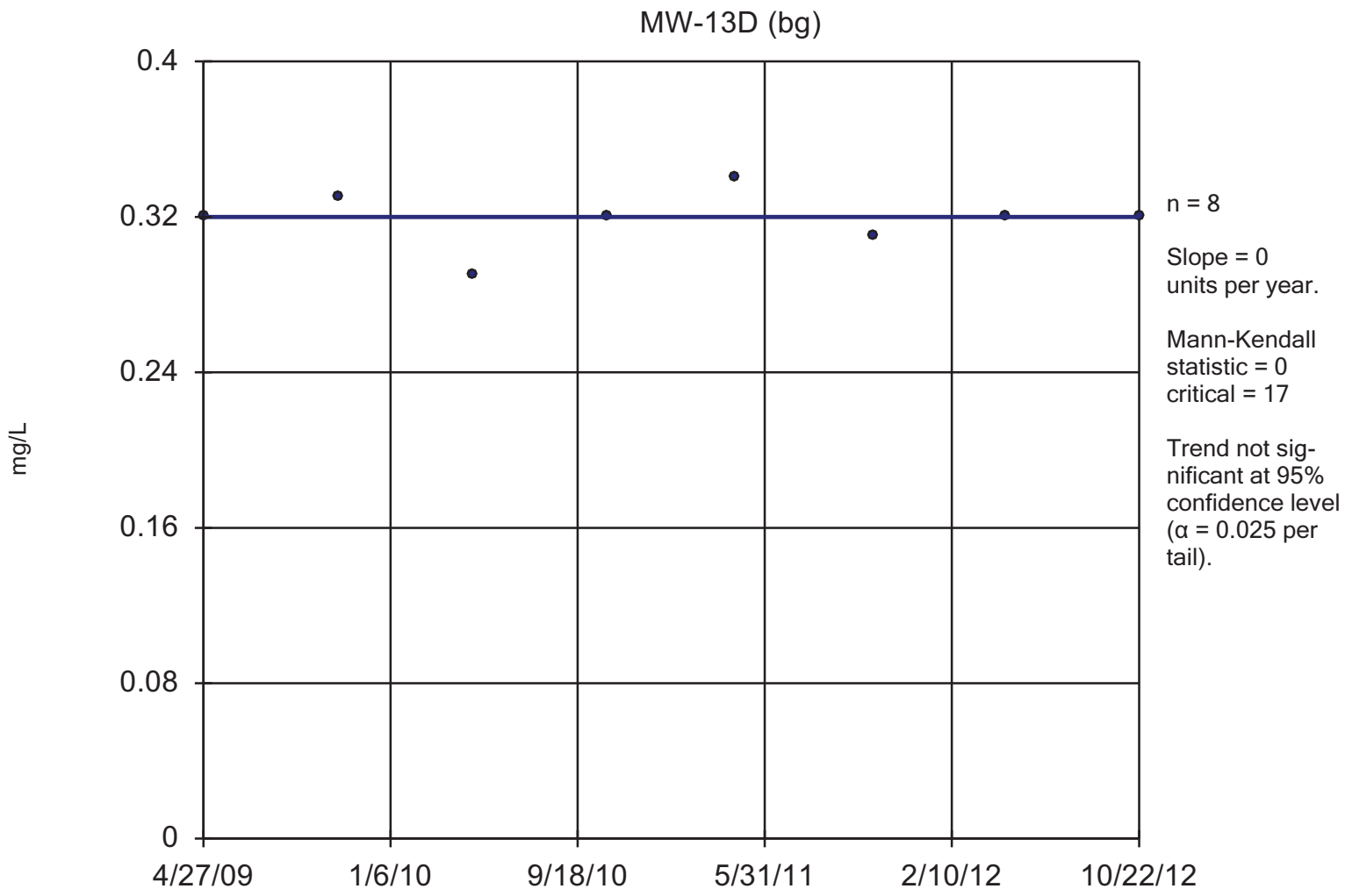
## MW-8




Constituent: Barium, dissolved  Analysis Run 12/14/2012 9:25 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

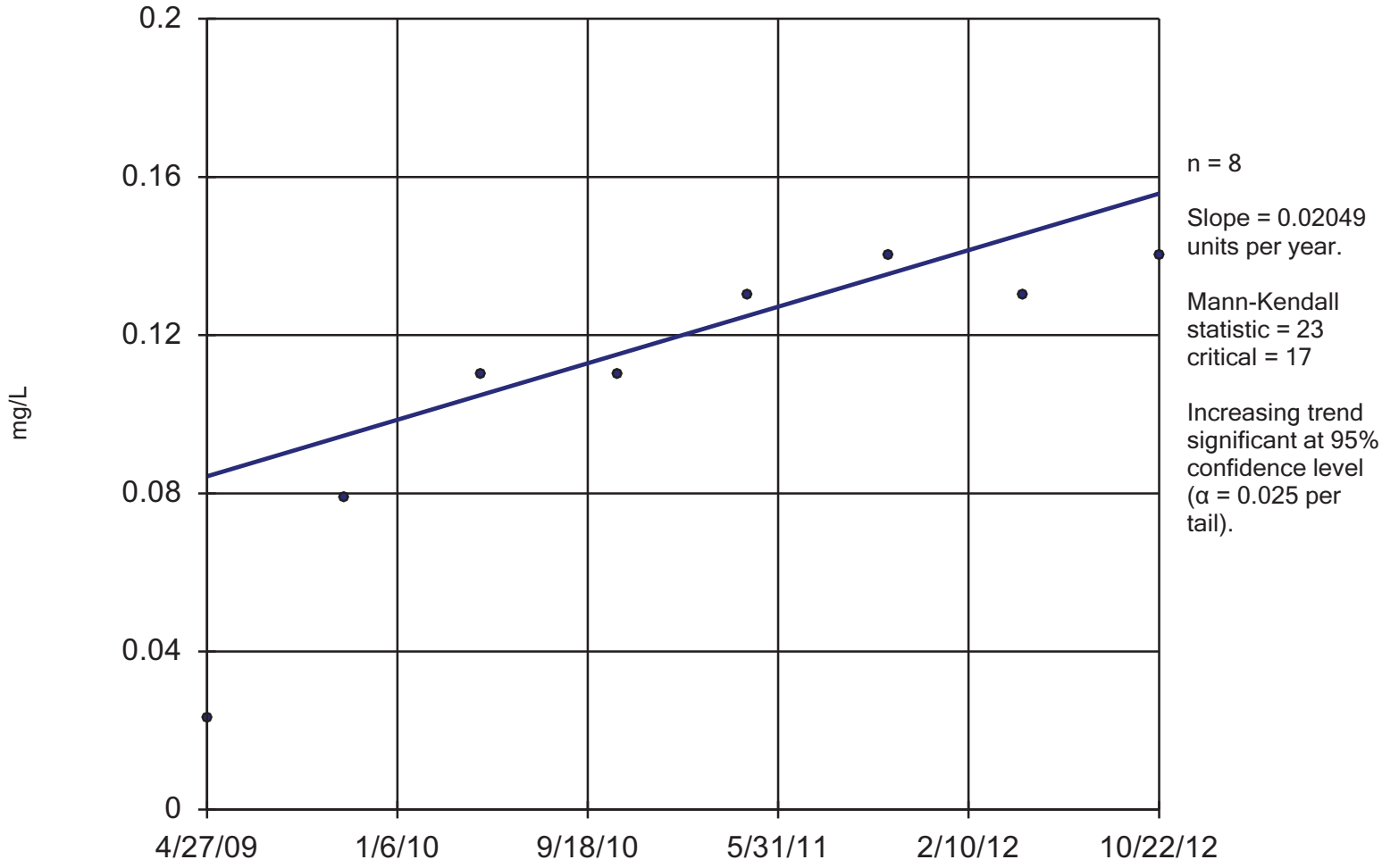



Constituent: Barium, dissolved  Analysis Run 12/14/2012 9:25 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-13S (bg)

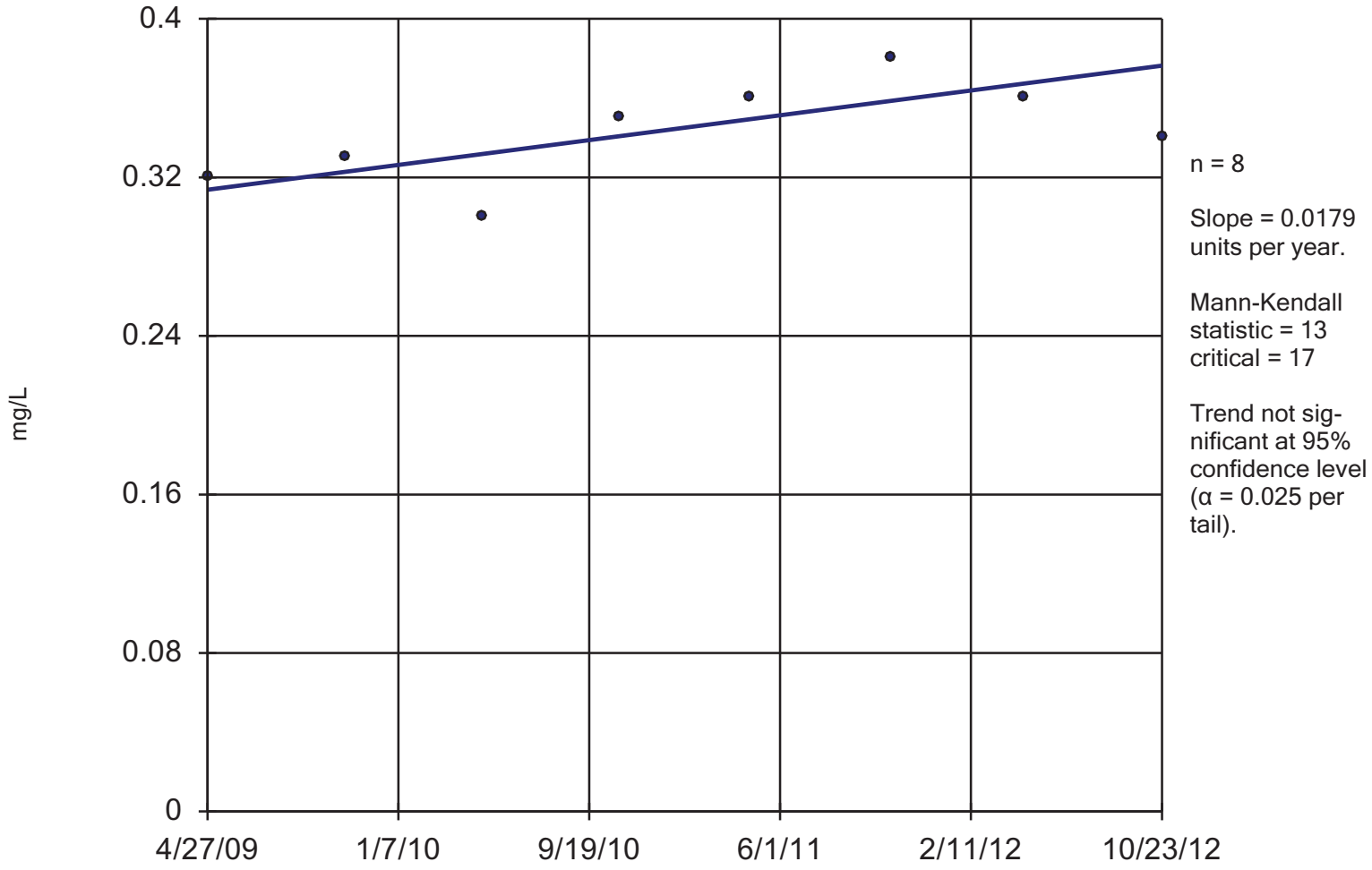



Constituent: Barium, dissolved  Analysis Run 12/14/2012 9:25 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

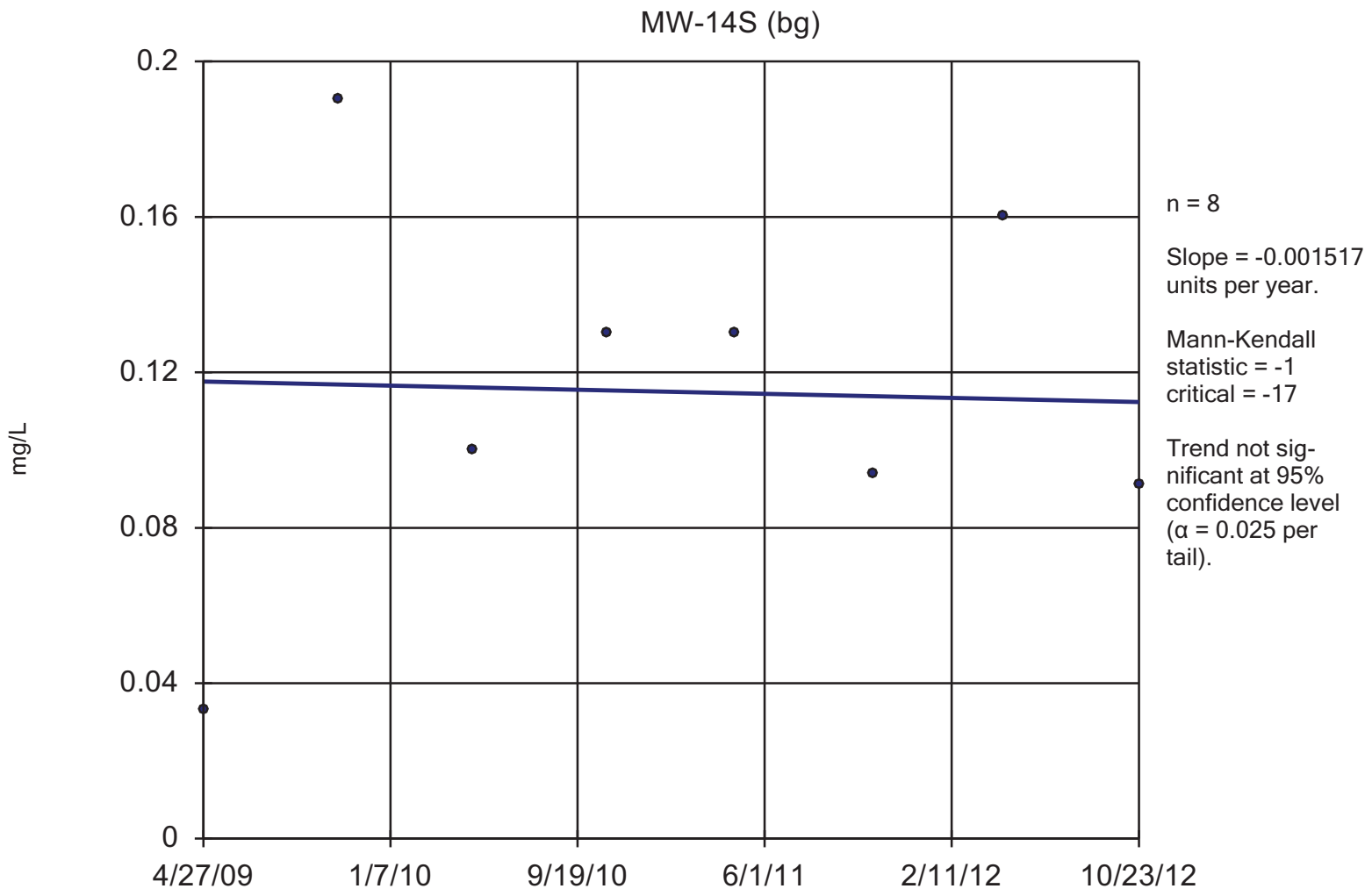
## MW-14D (bg)




Constituent: Barium, dissolved  Analysis Run 12/14/2012 9:25 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

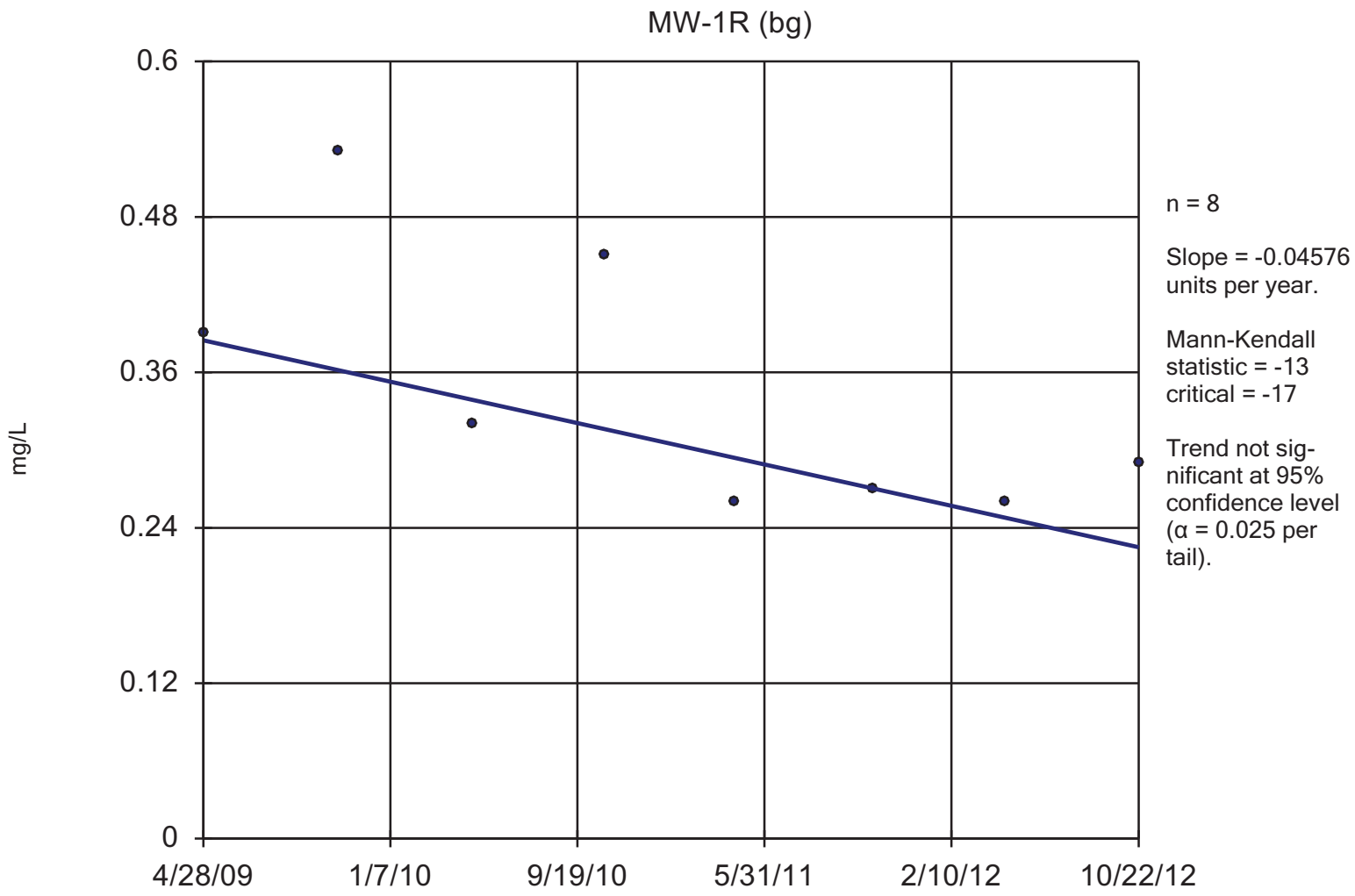
# Sen's Slope Estimator




Constituent: Barium, dissolved  Analysis Run 12/14/2012 9:25 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

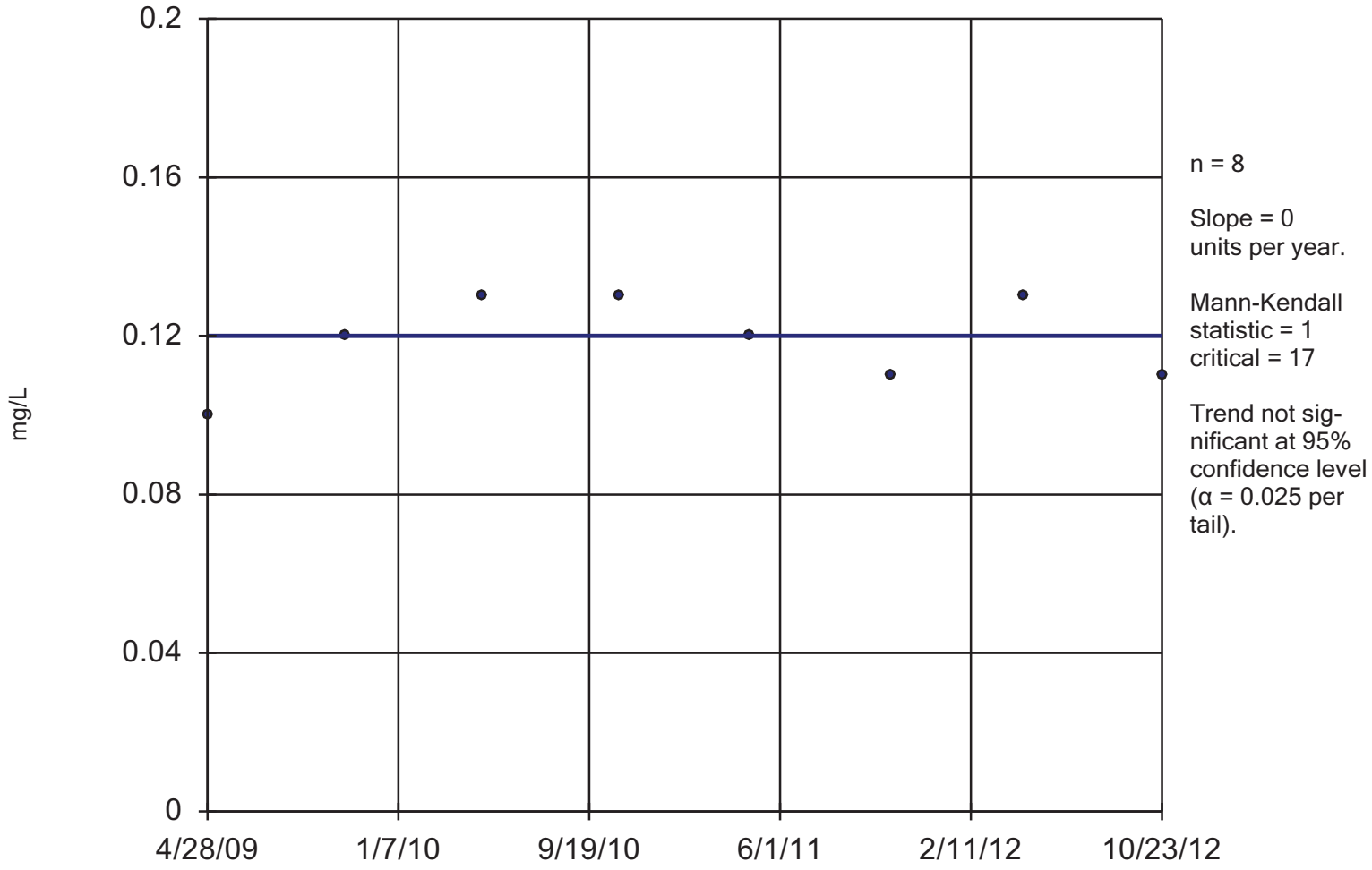



Constituent: Barium, dissolved  Analysis Run 12/14/2012 9:25 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-6

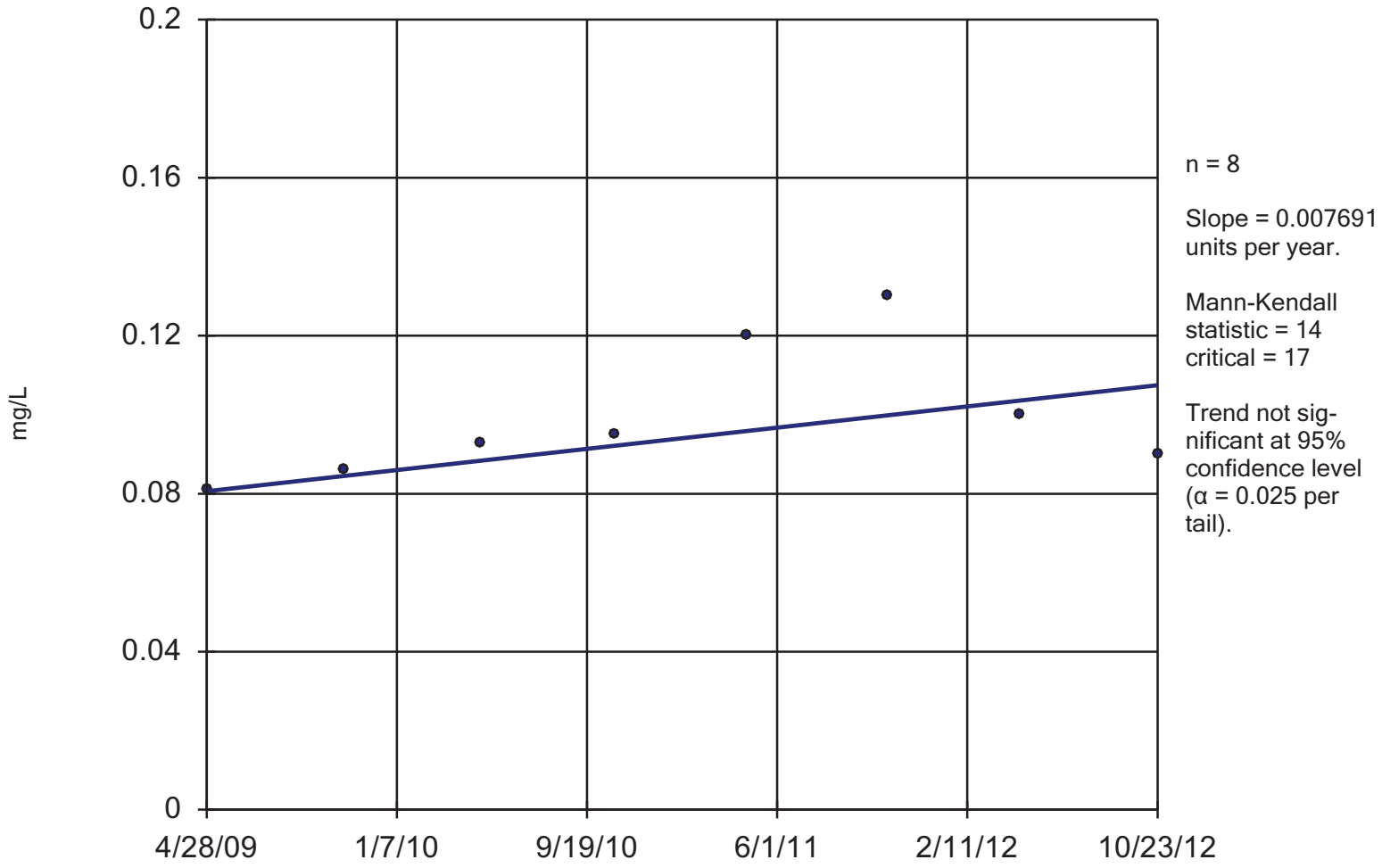



Constituent: Barium, dissolved  Analysis Run 12/14/2012 9:25 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-7

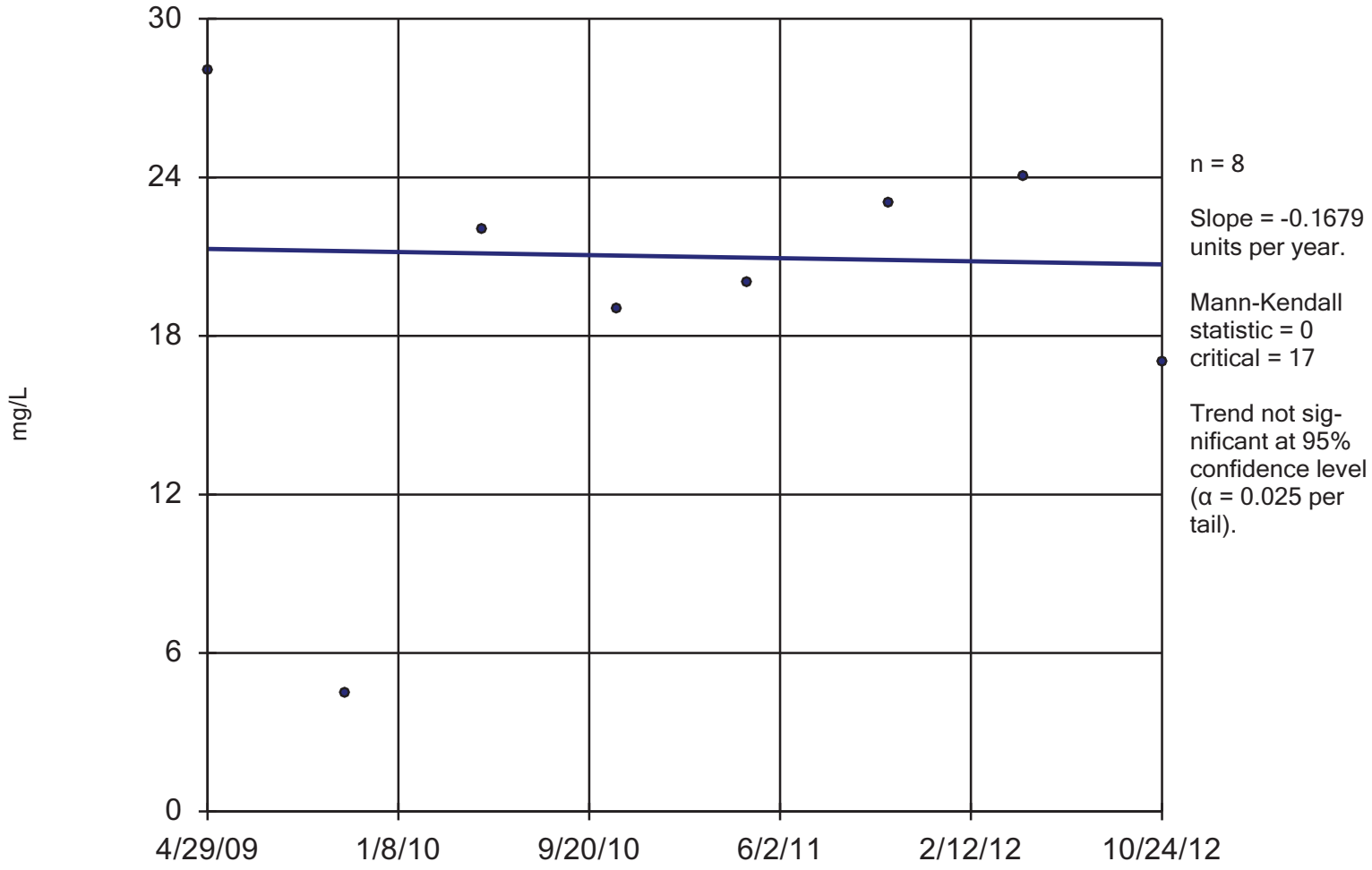



Constituent: Barium, dissolved  Analysis Run 12/14/2012 9:25 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-10

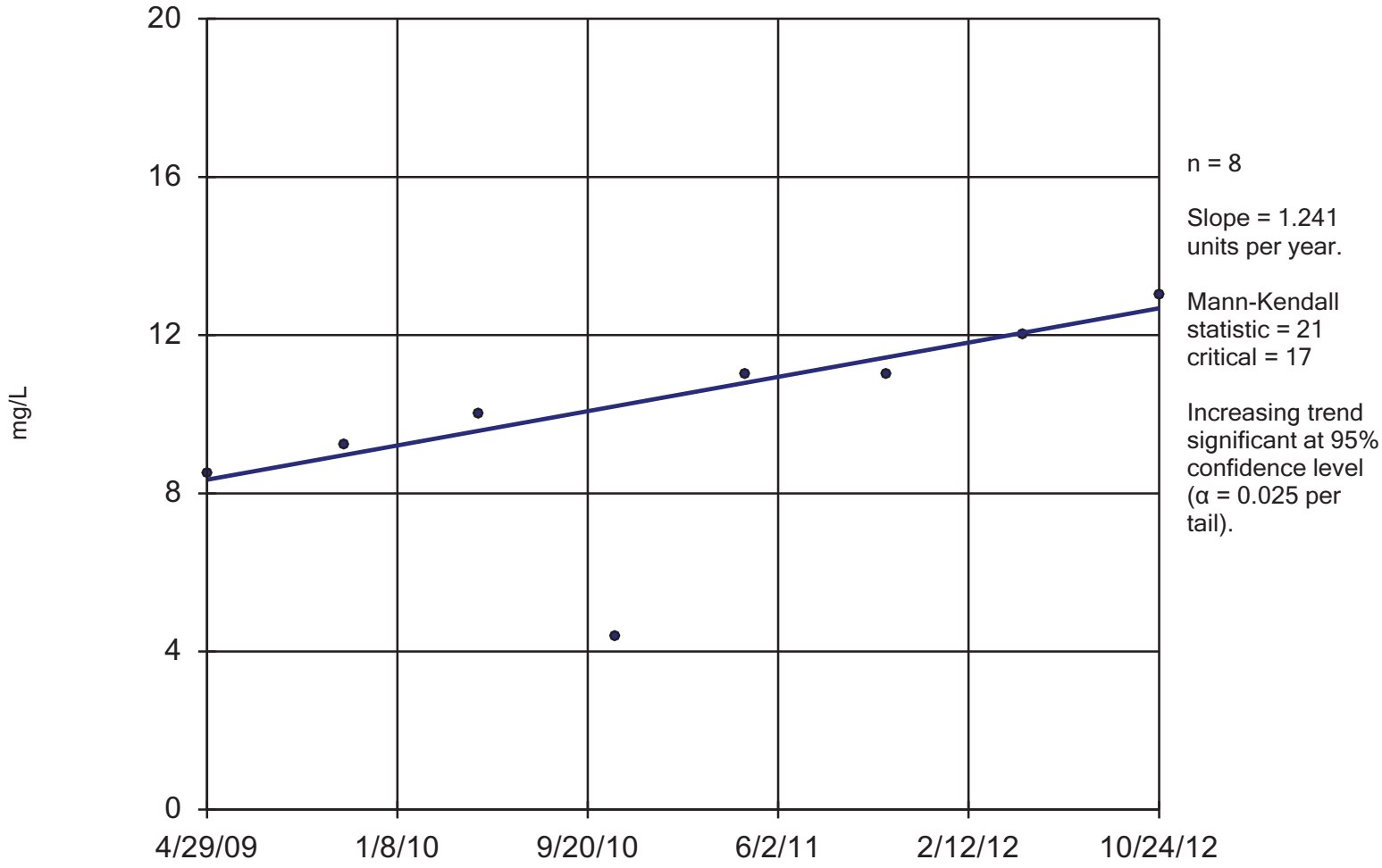



Constituent: Boron, dissolved  Analysis Run 12/14/2012 9:25 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-11

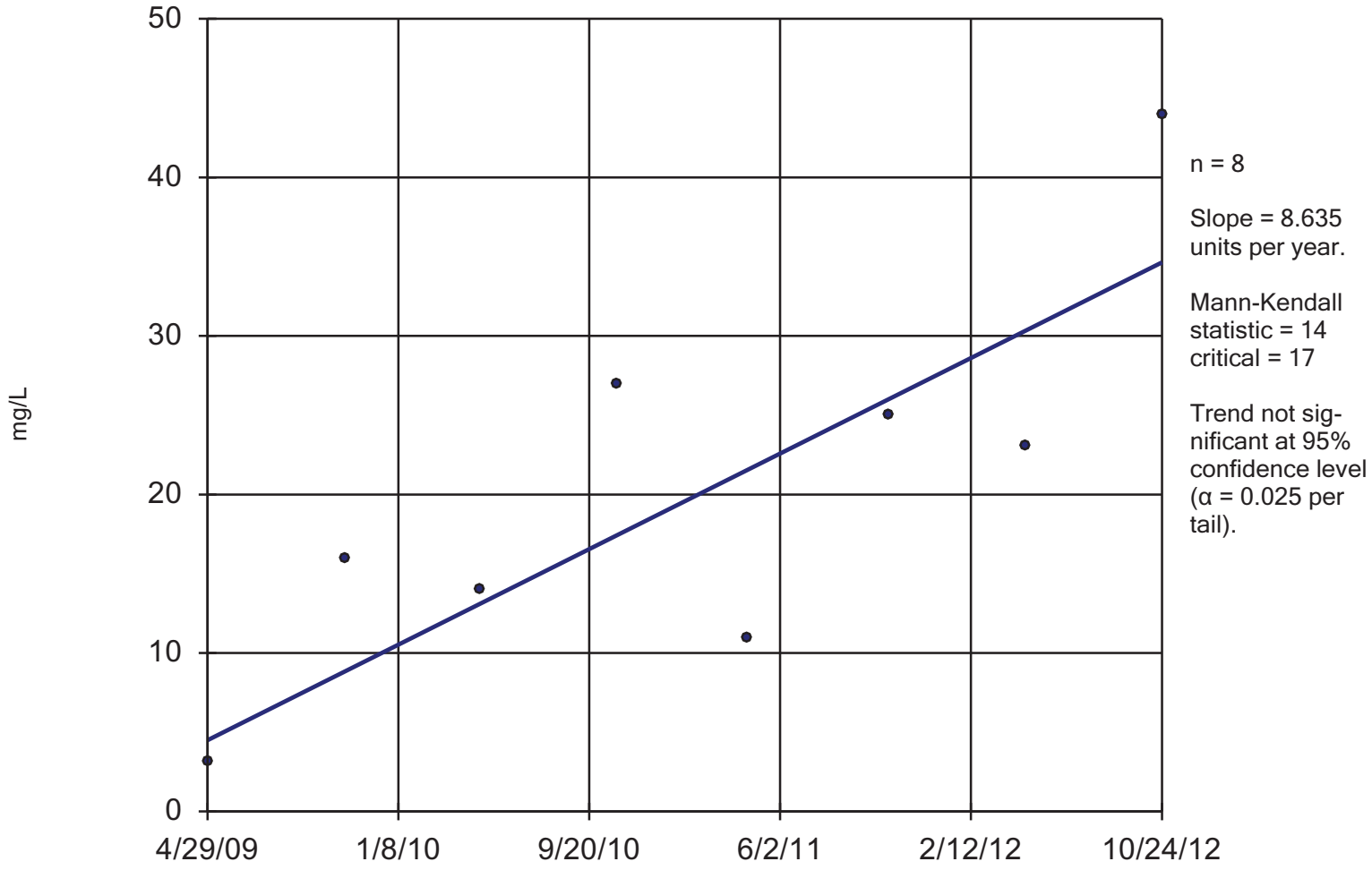



Constituent: Boron, dissolved  Analysis Run 12/14/2012 9:25 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

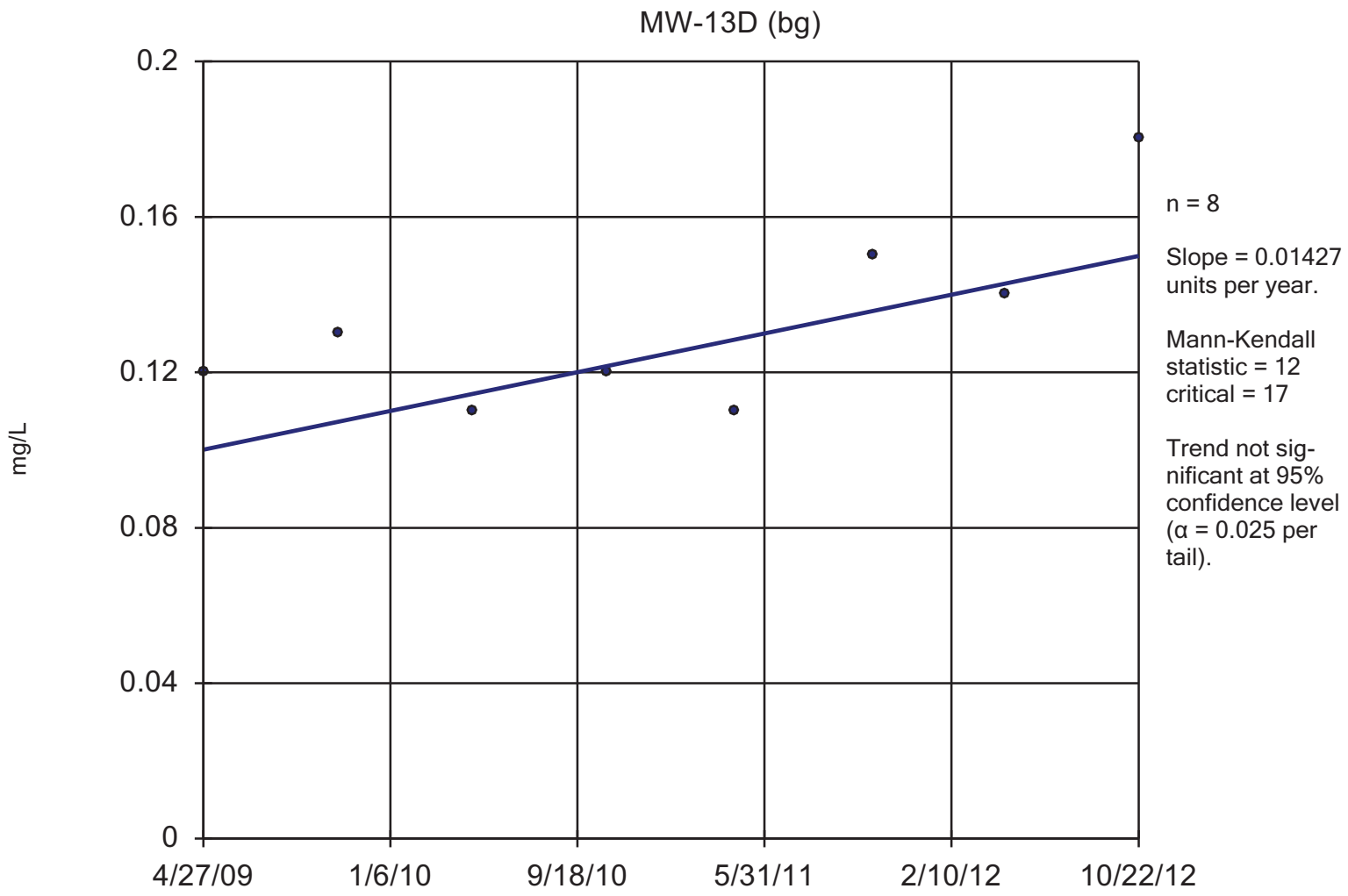
## MW-8




Constituent: Boron, dissolved  Analysis Run 12/14/2012 9:25 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

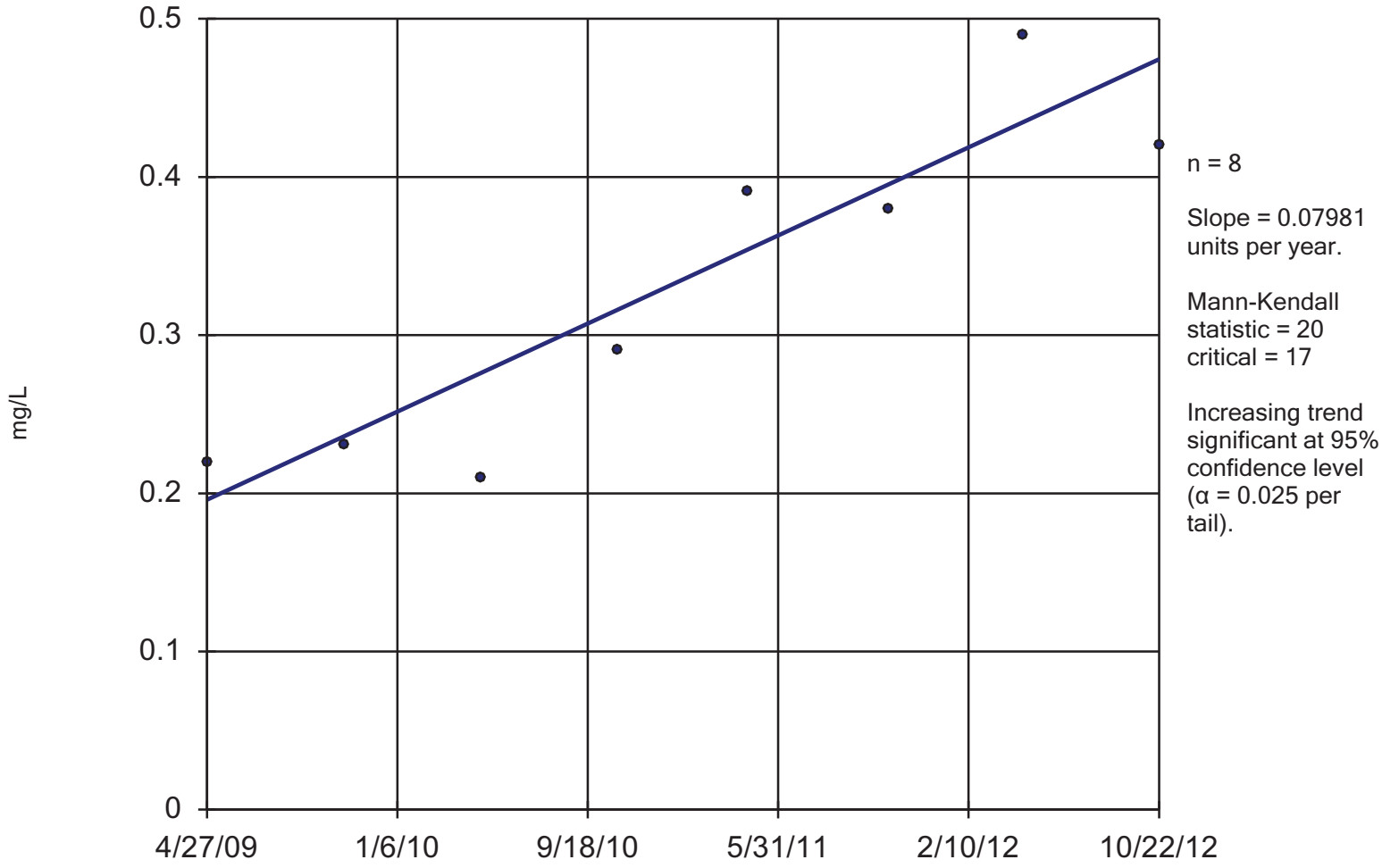



Constituent: Boron, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-13S (bg)

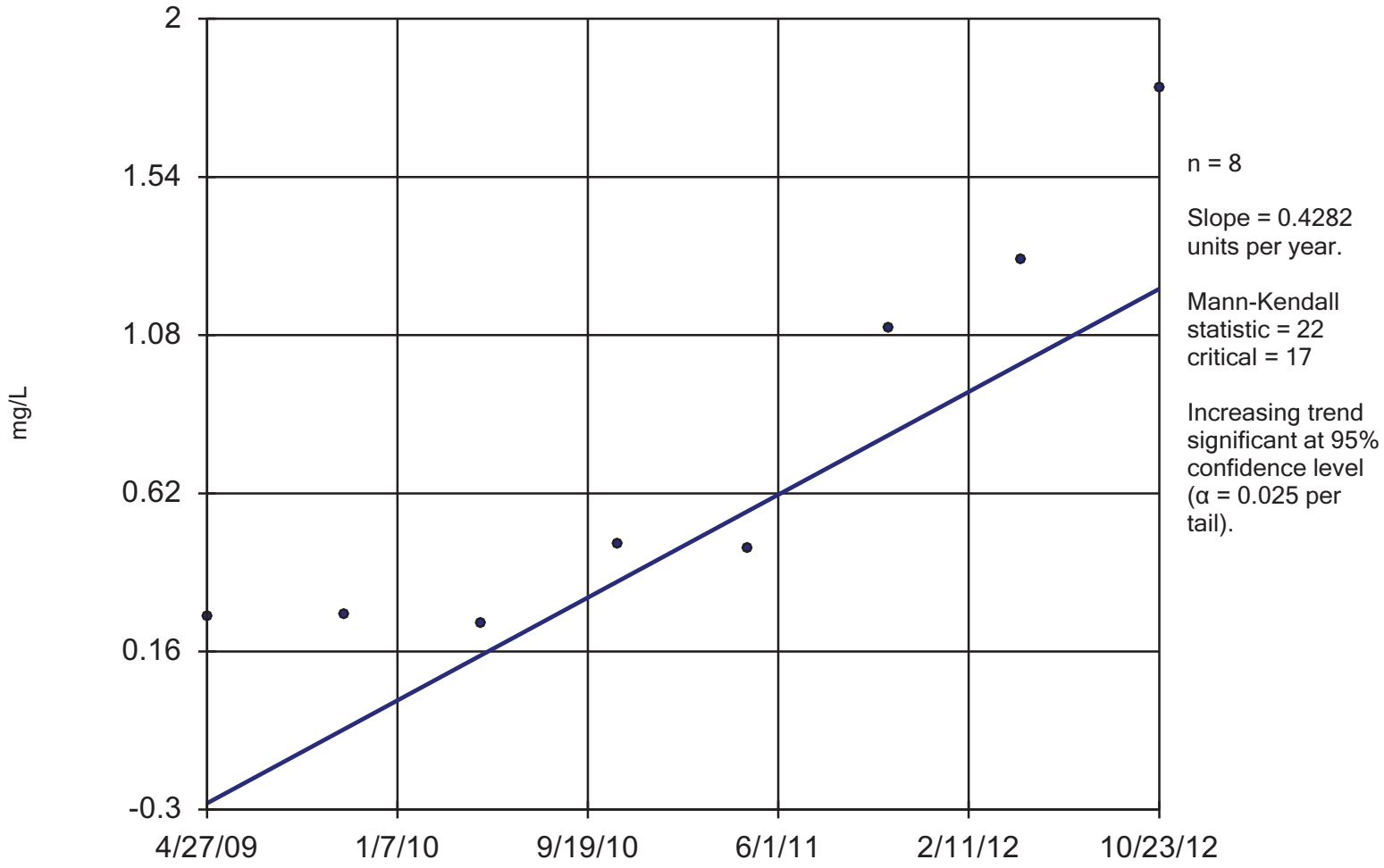



Constituent: Boron, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-14D (bg)



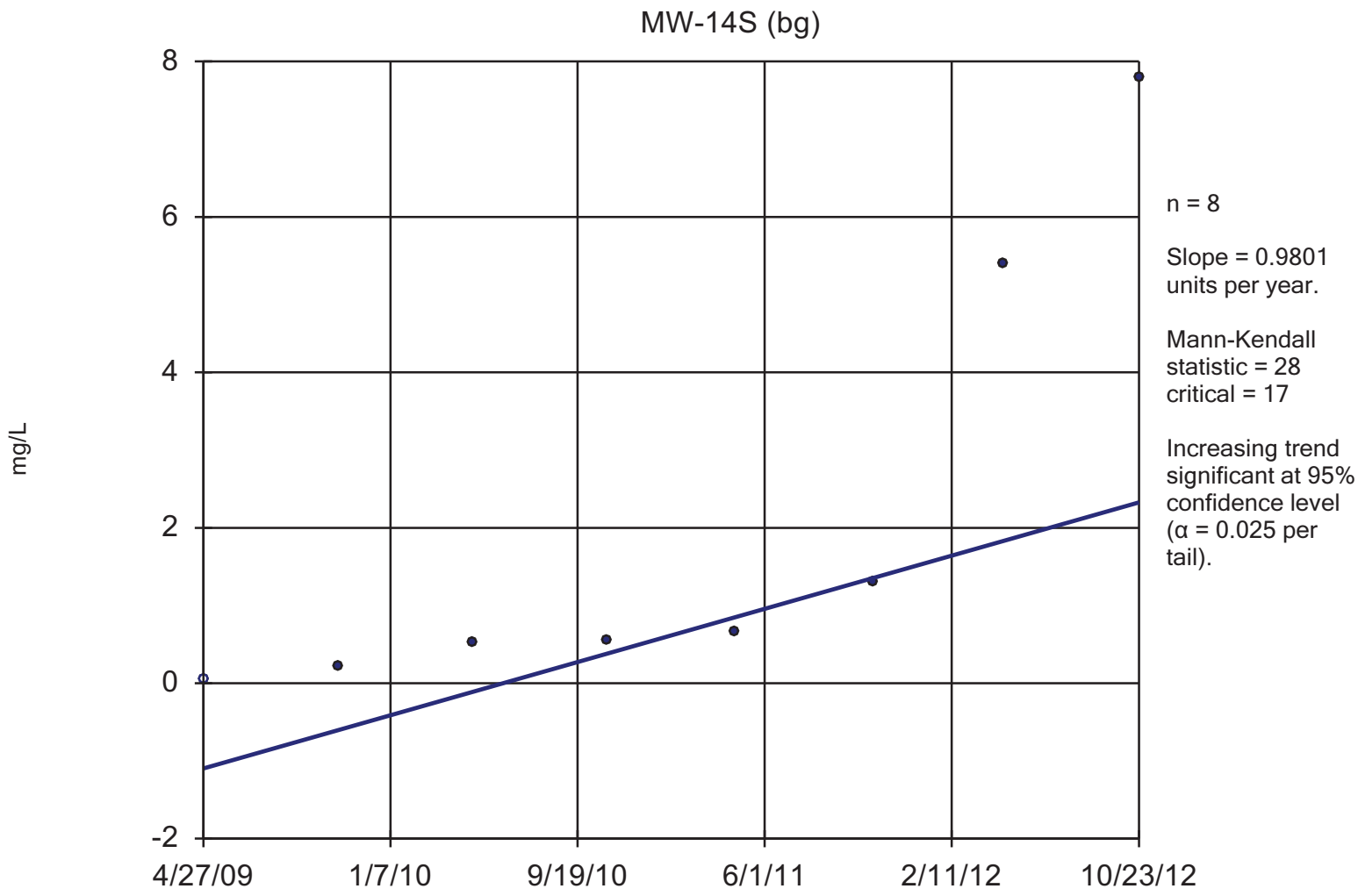

Constituent: Boron, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator

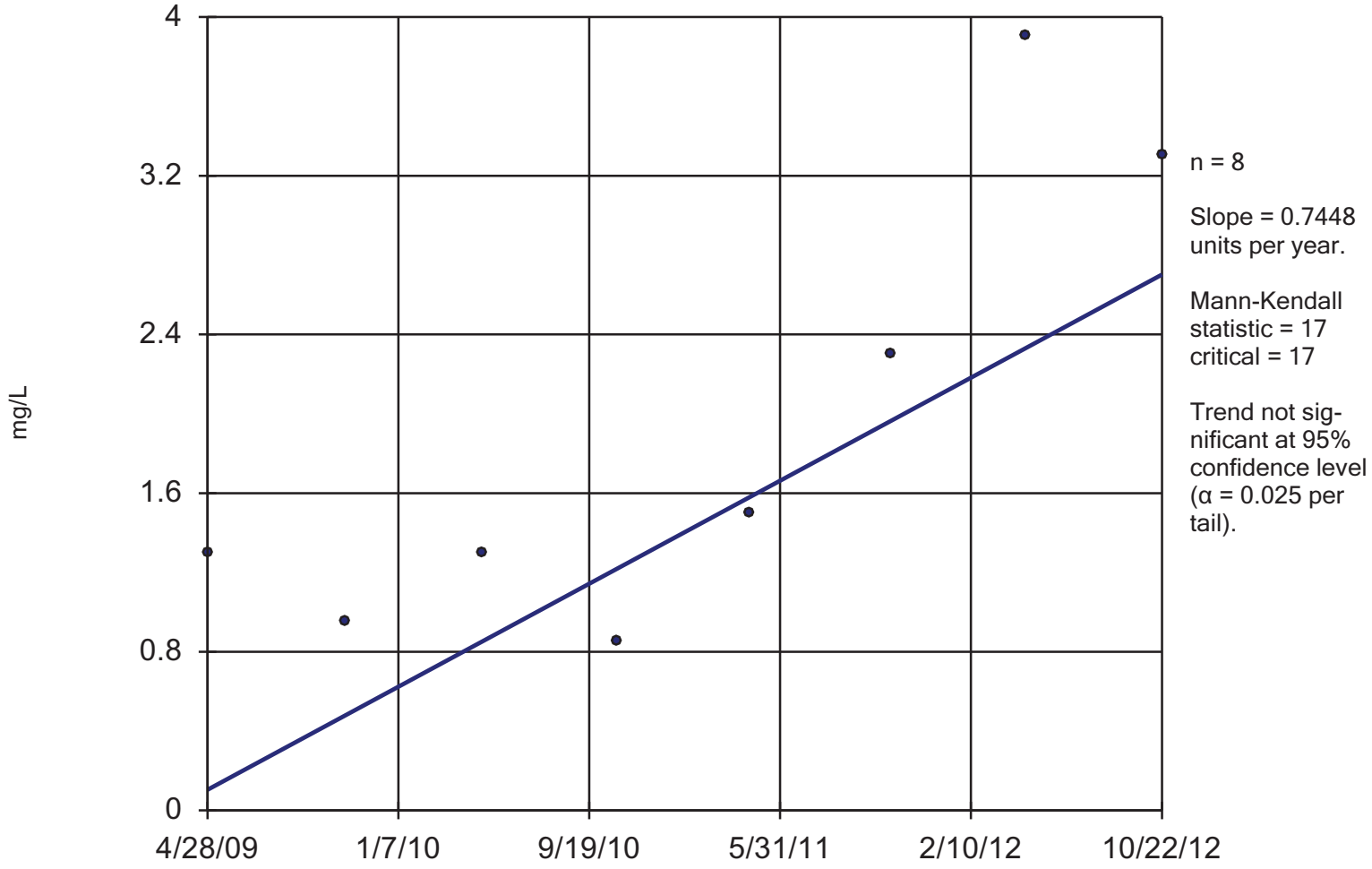



Constituent: Boron, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-1R (bg)

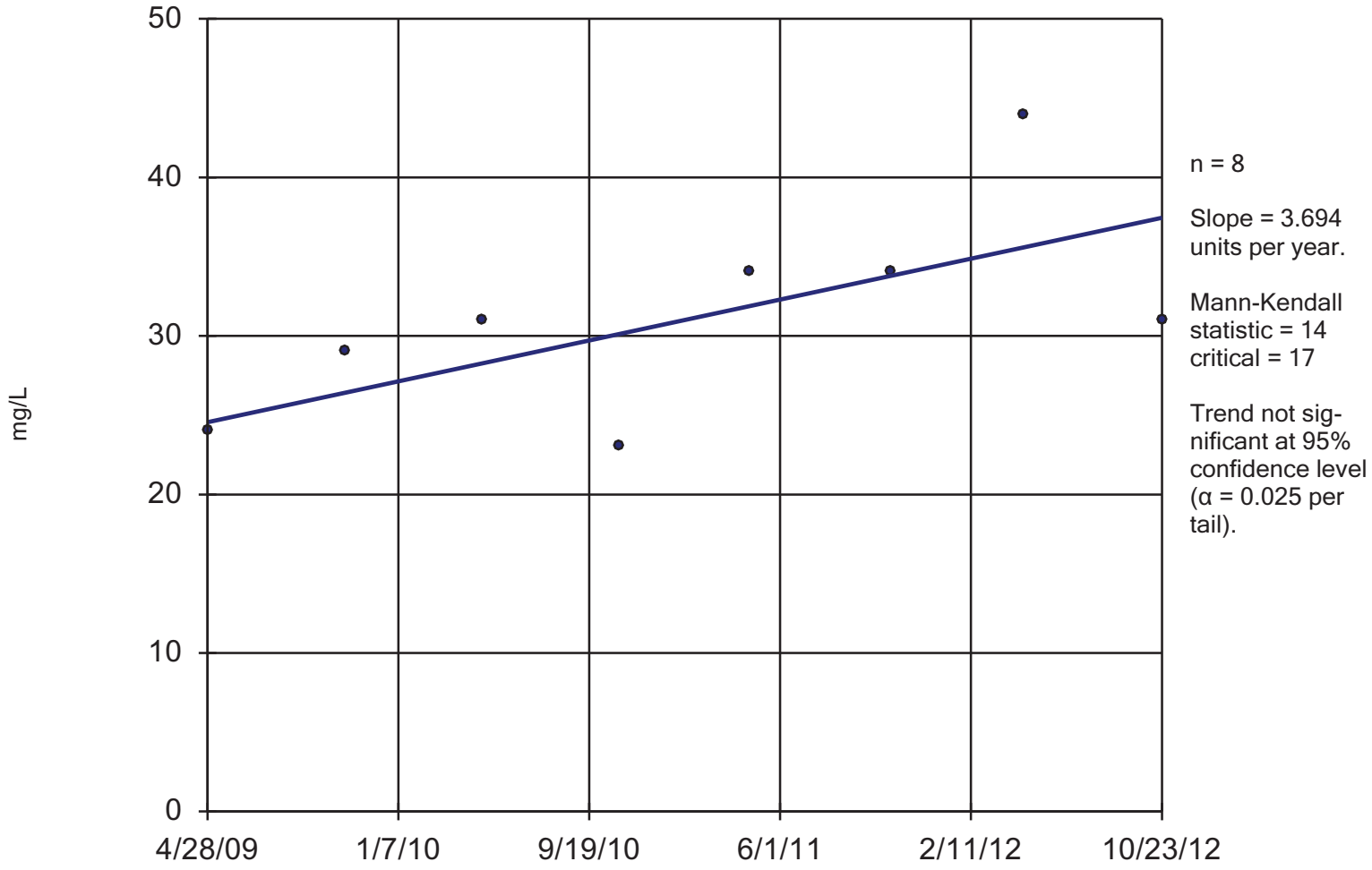



Constituent: Boron, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-6

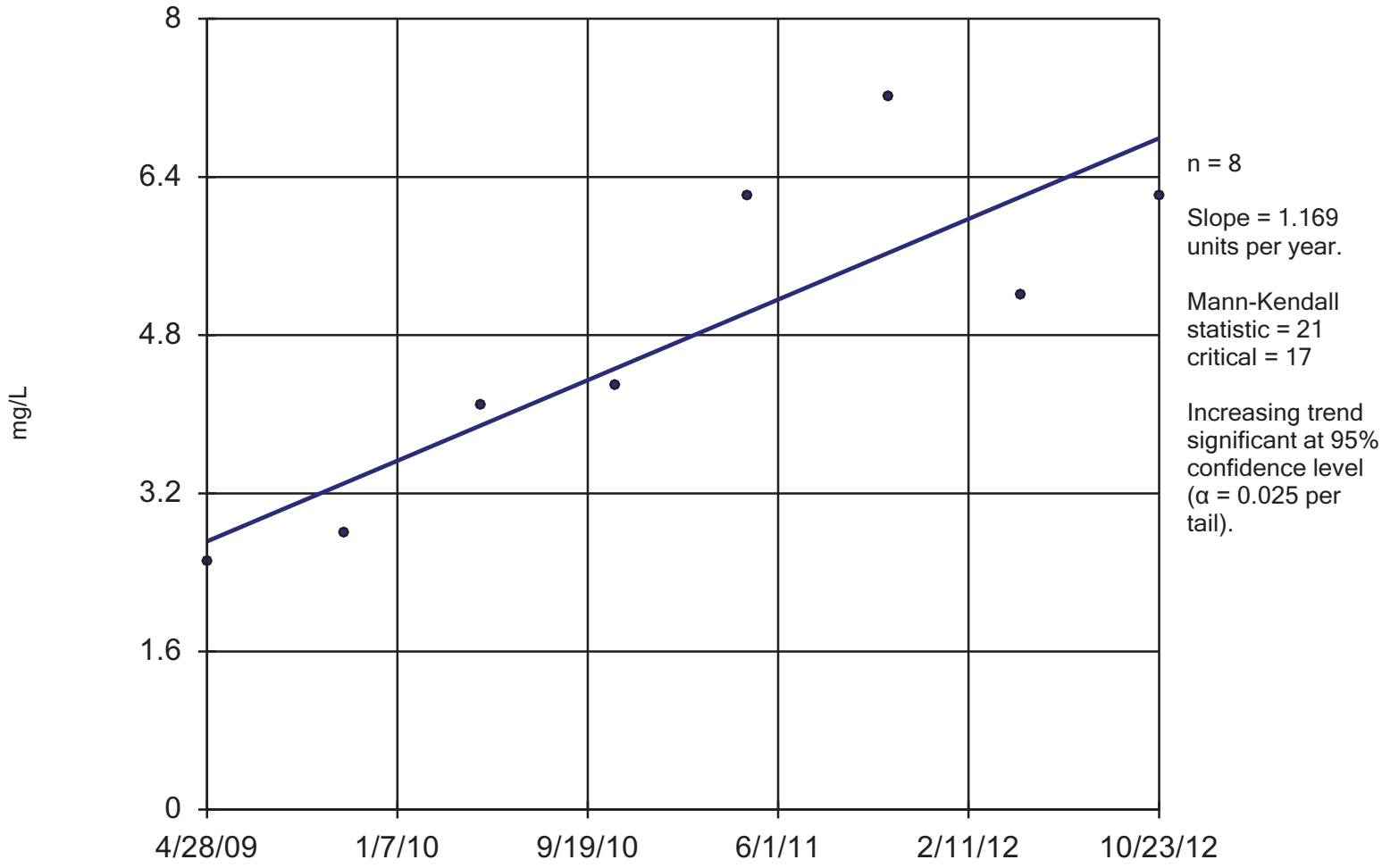



Constituent: Boron, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-7

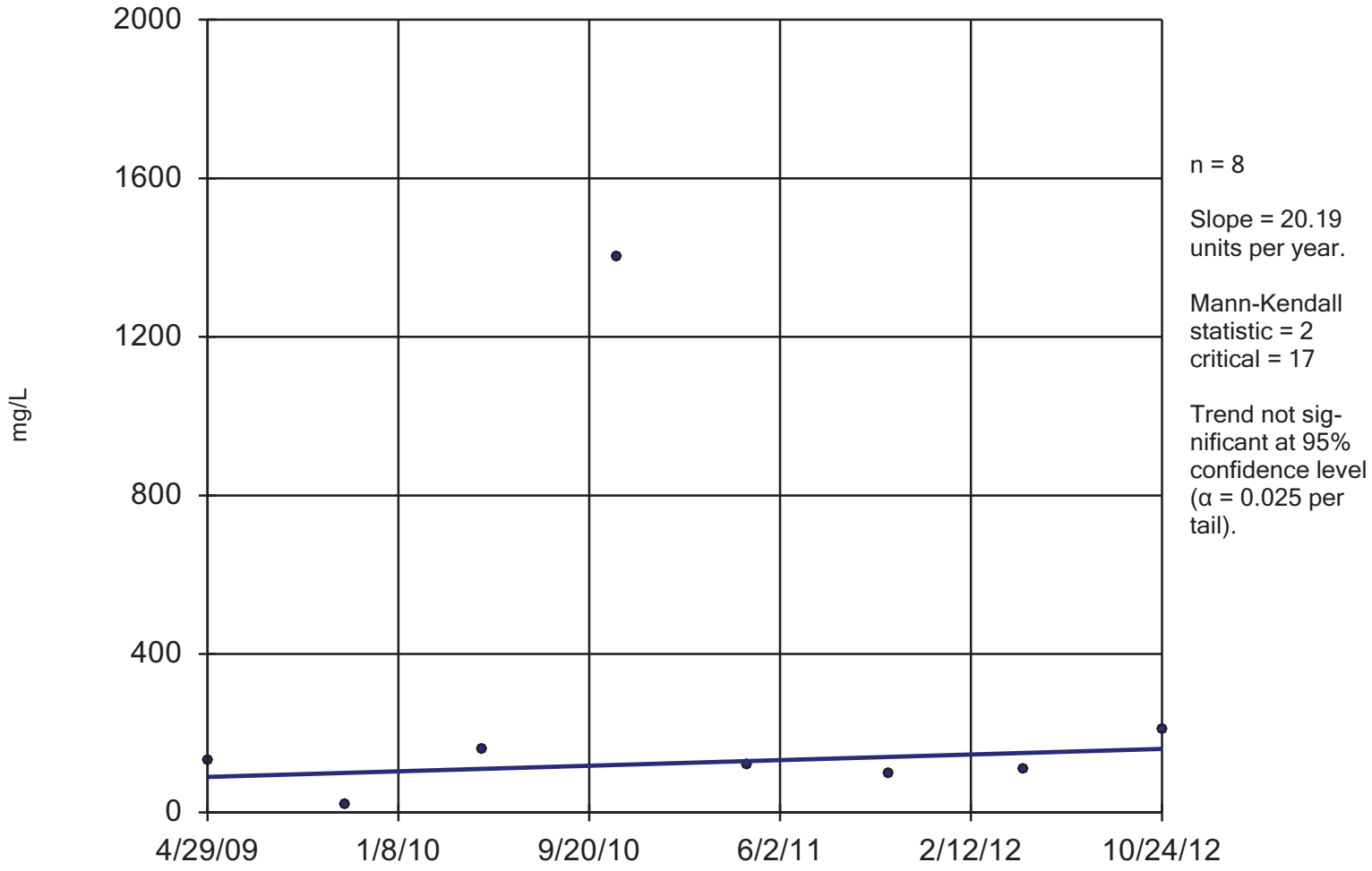



Constituent: Boron, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-10

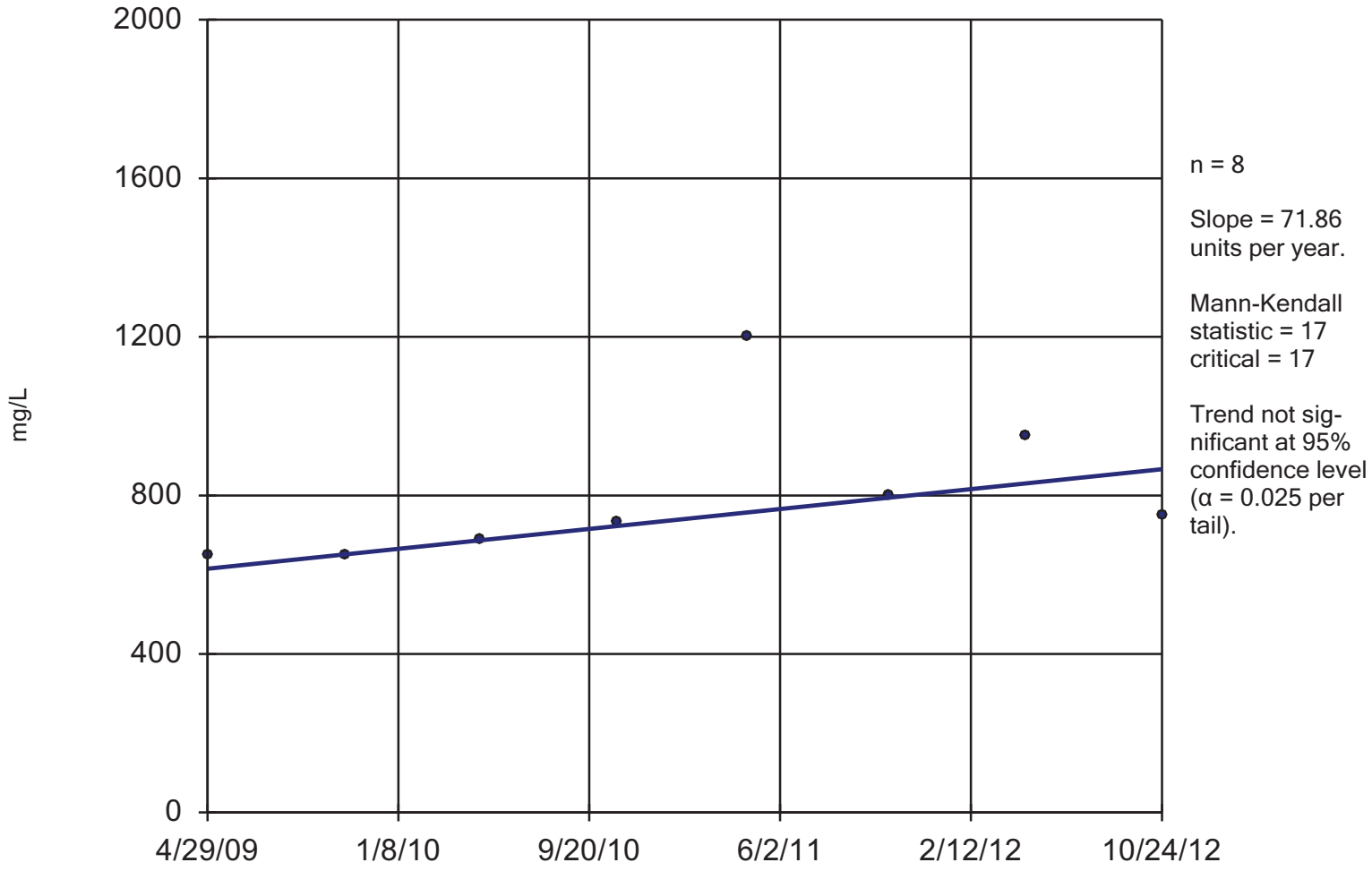



Constituent: Chloride  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-11

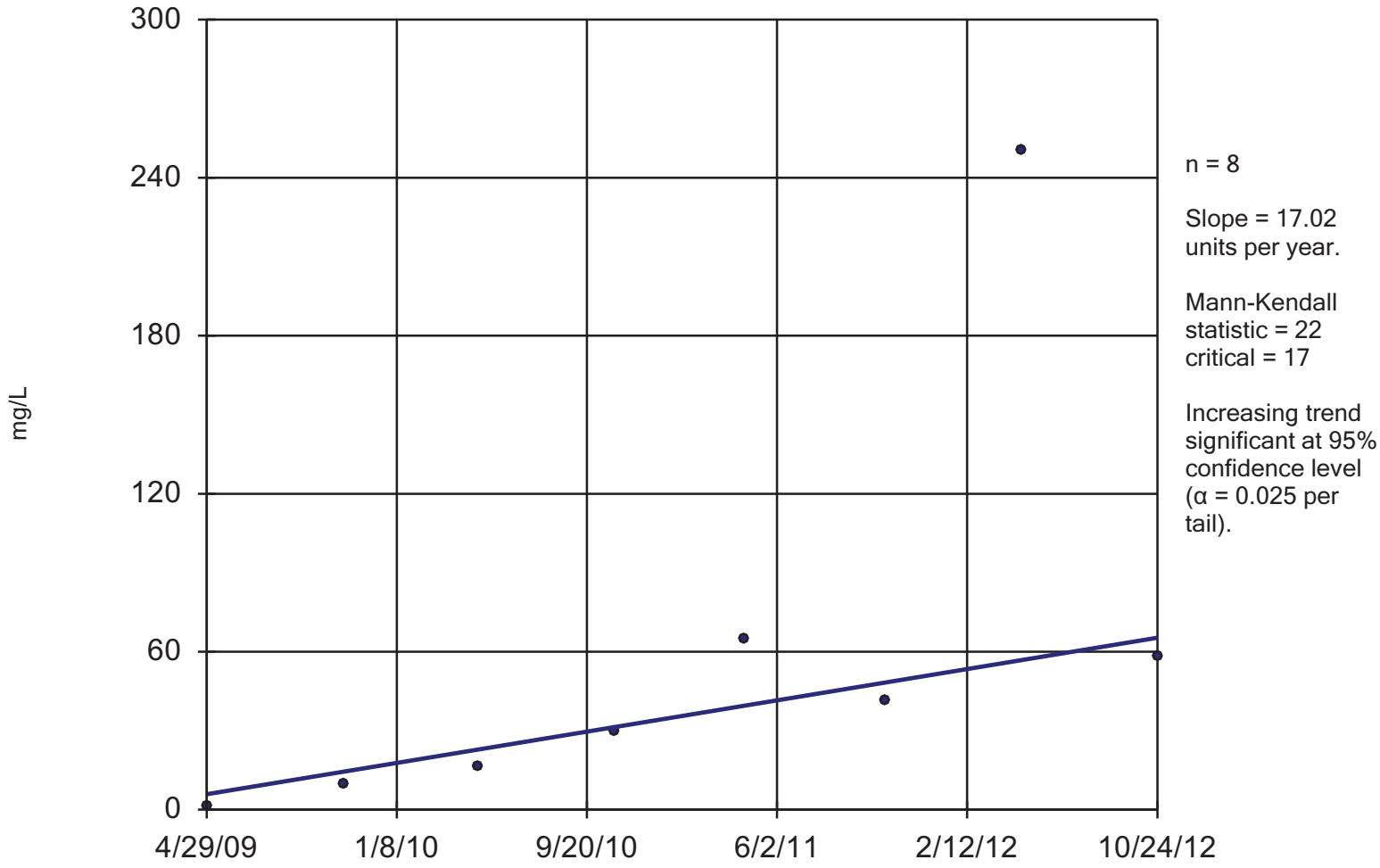



Constituent: Chloride  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-8

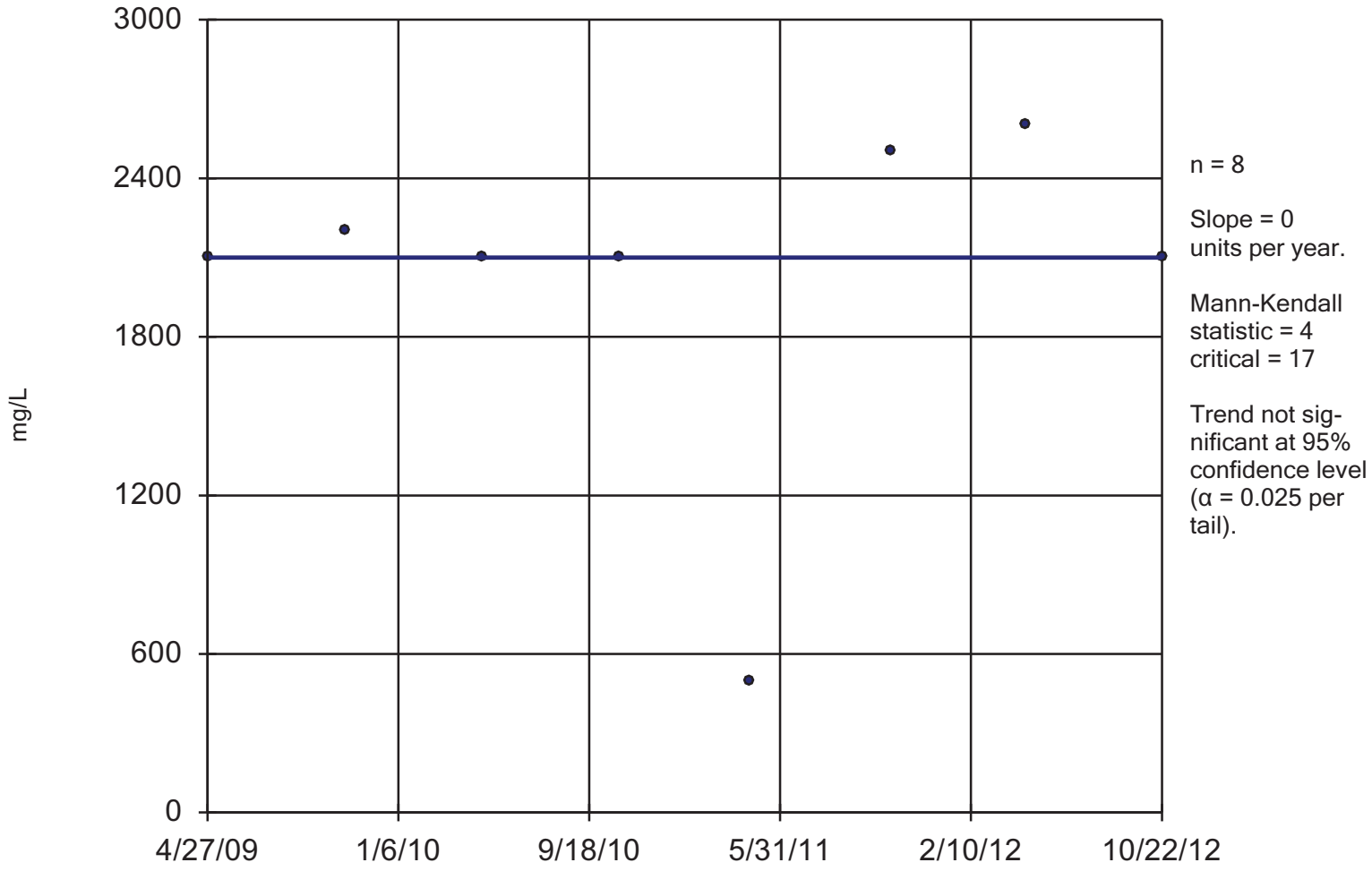



Constituent: Chloride  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

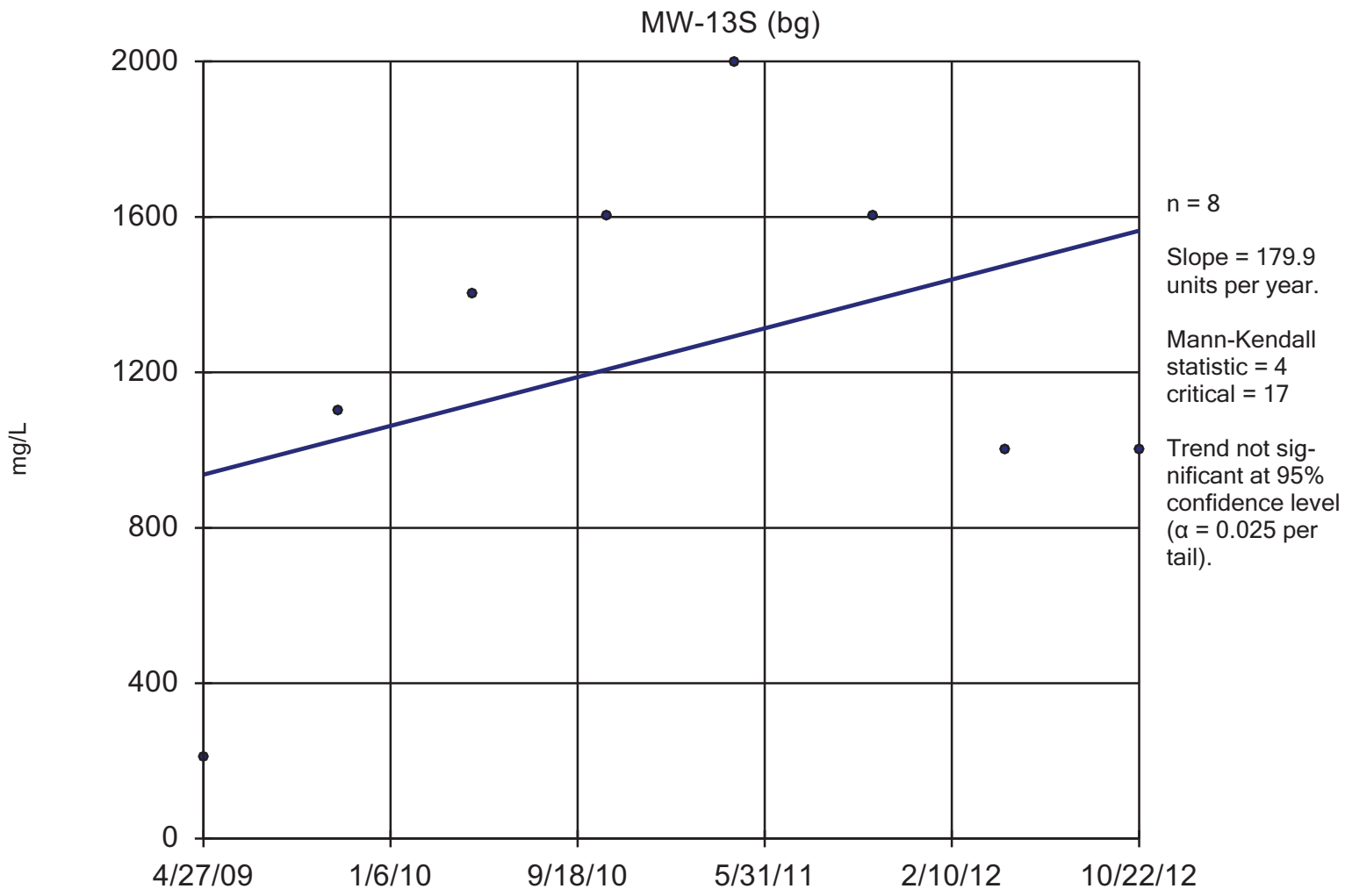
## MW-13D (bg)




Constituent: Chloride  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

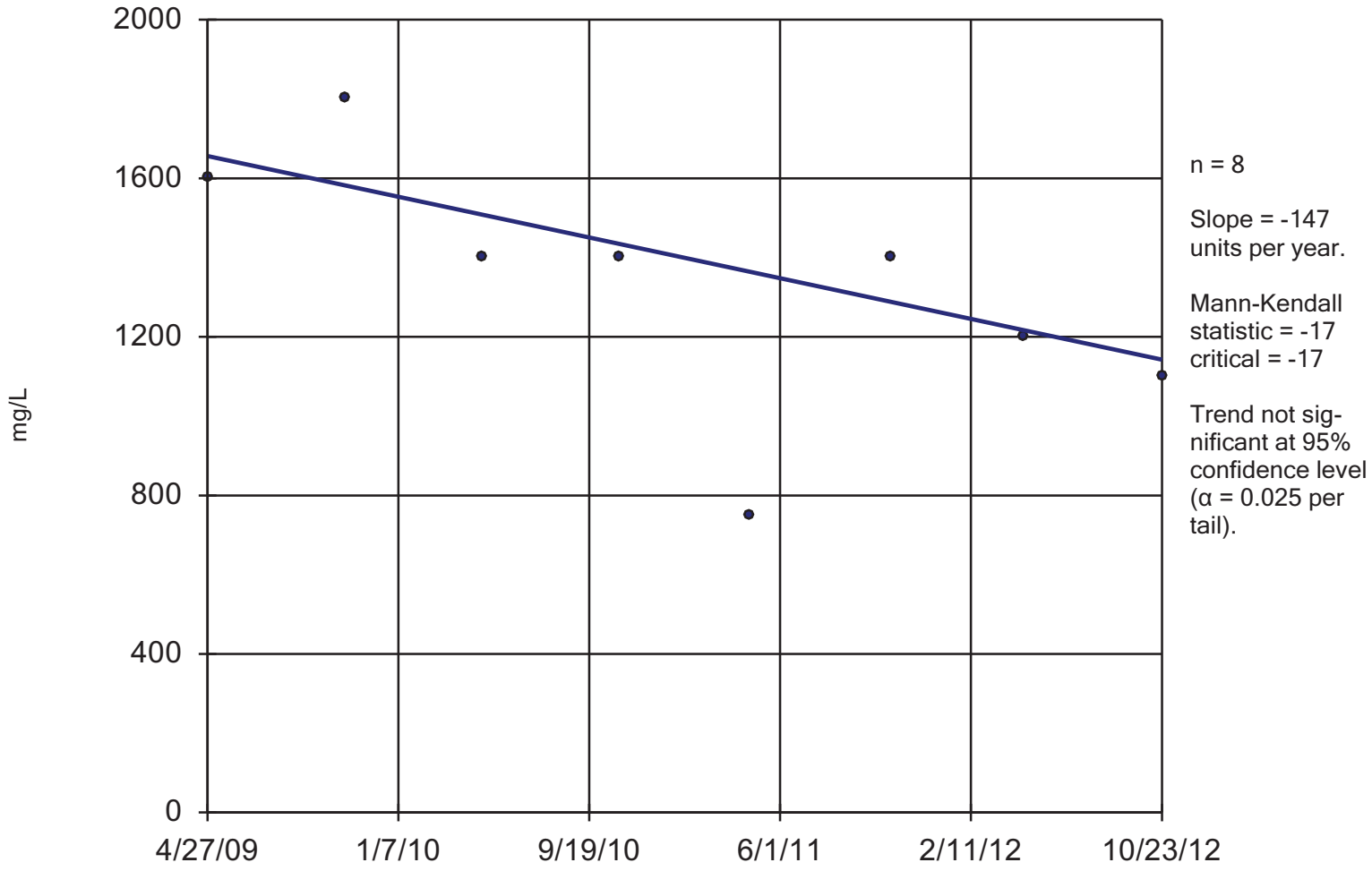



Constituent: Chloride  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-14D (bg)

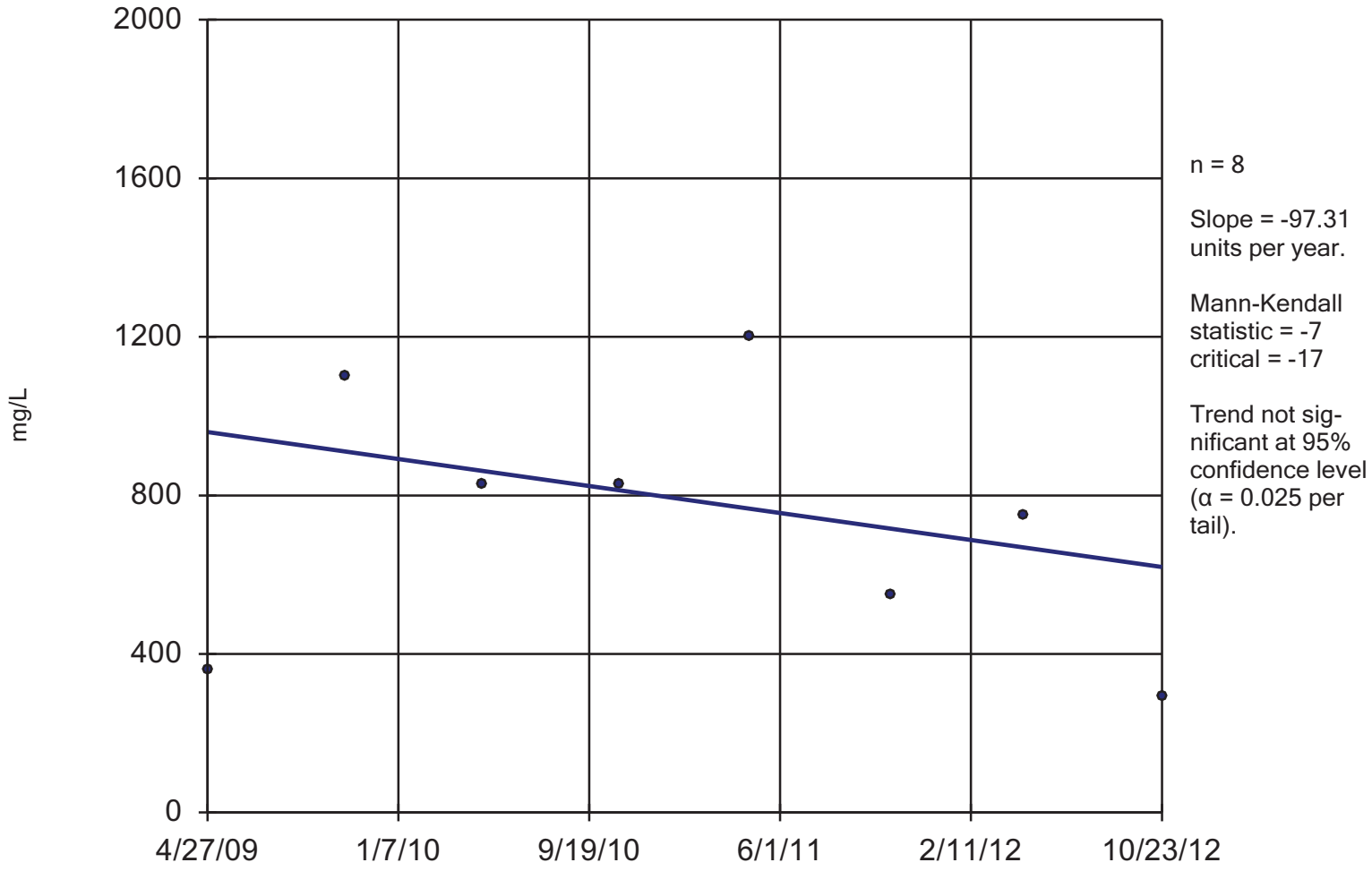



Constituent: Chloride  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-14S (bg)

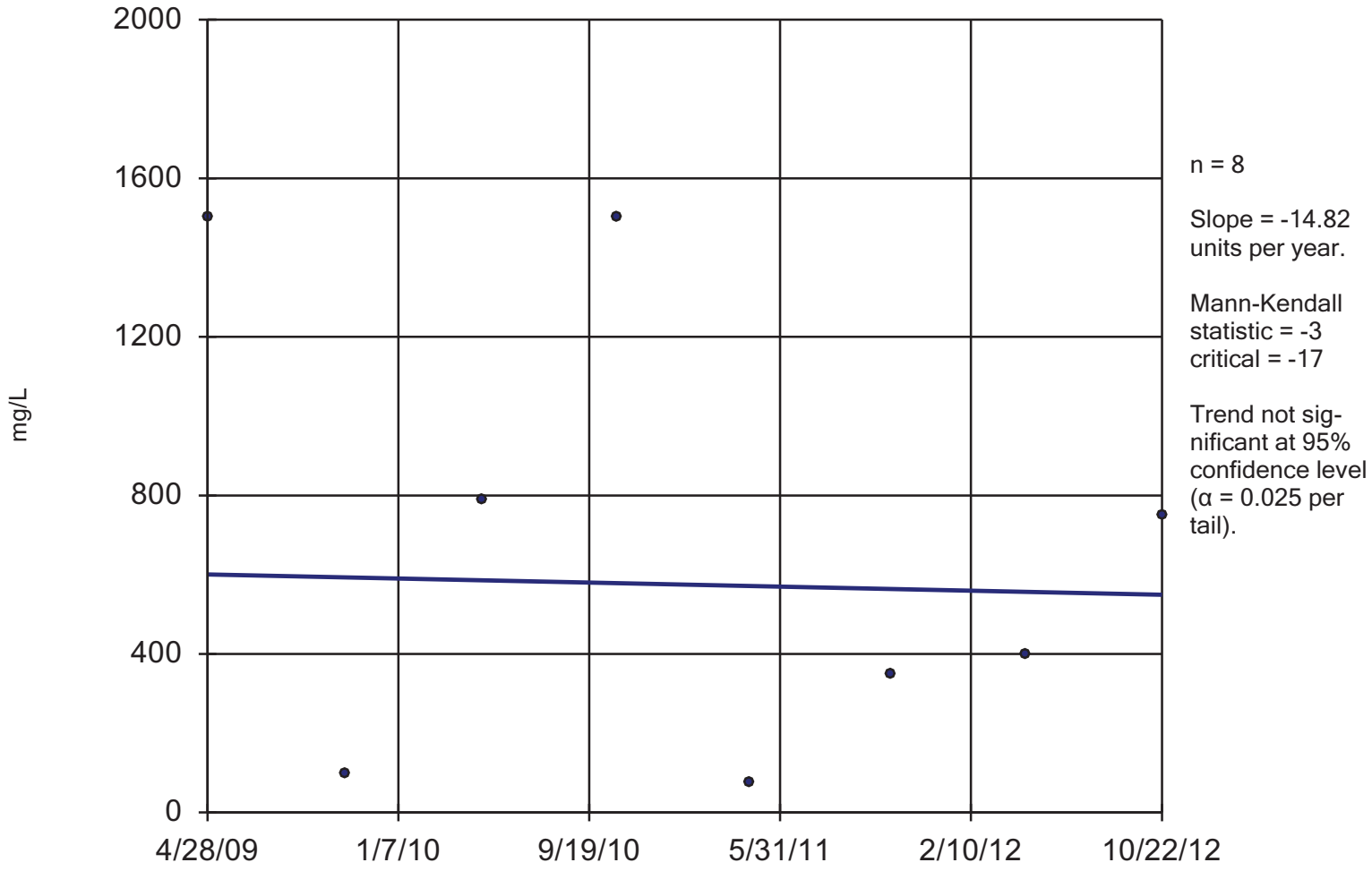



Constituent: Chloride  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-1R (bg)

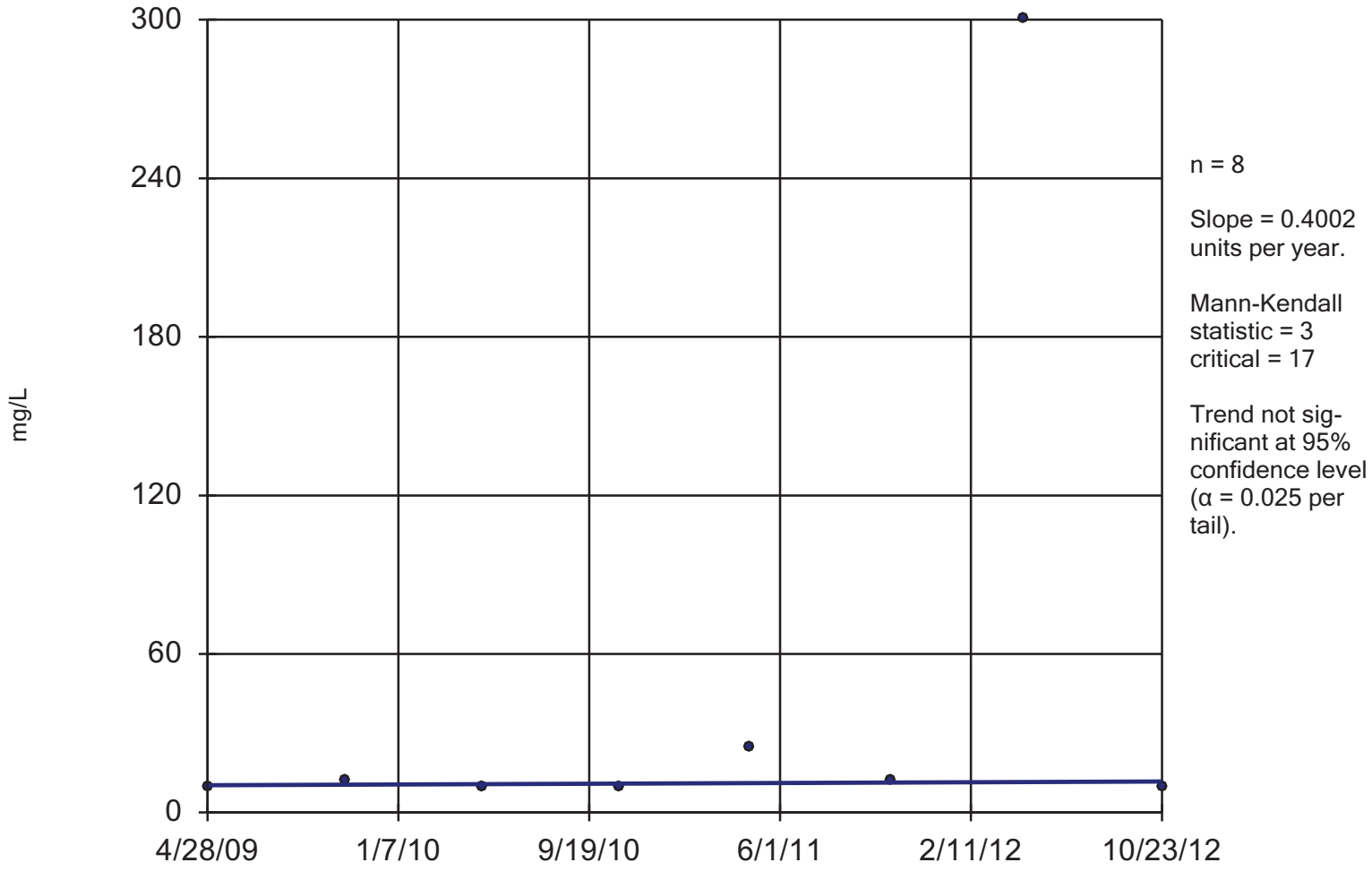



Constituent: Chloride  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-6

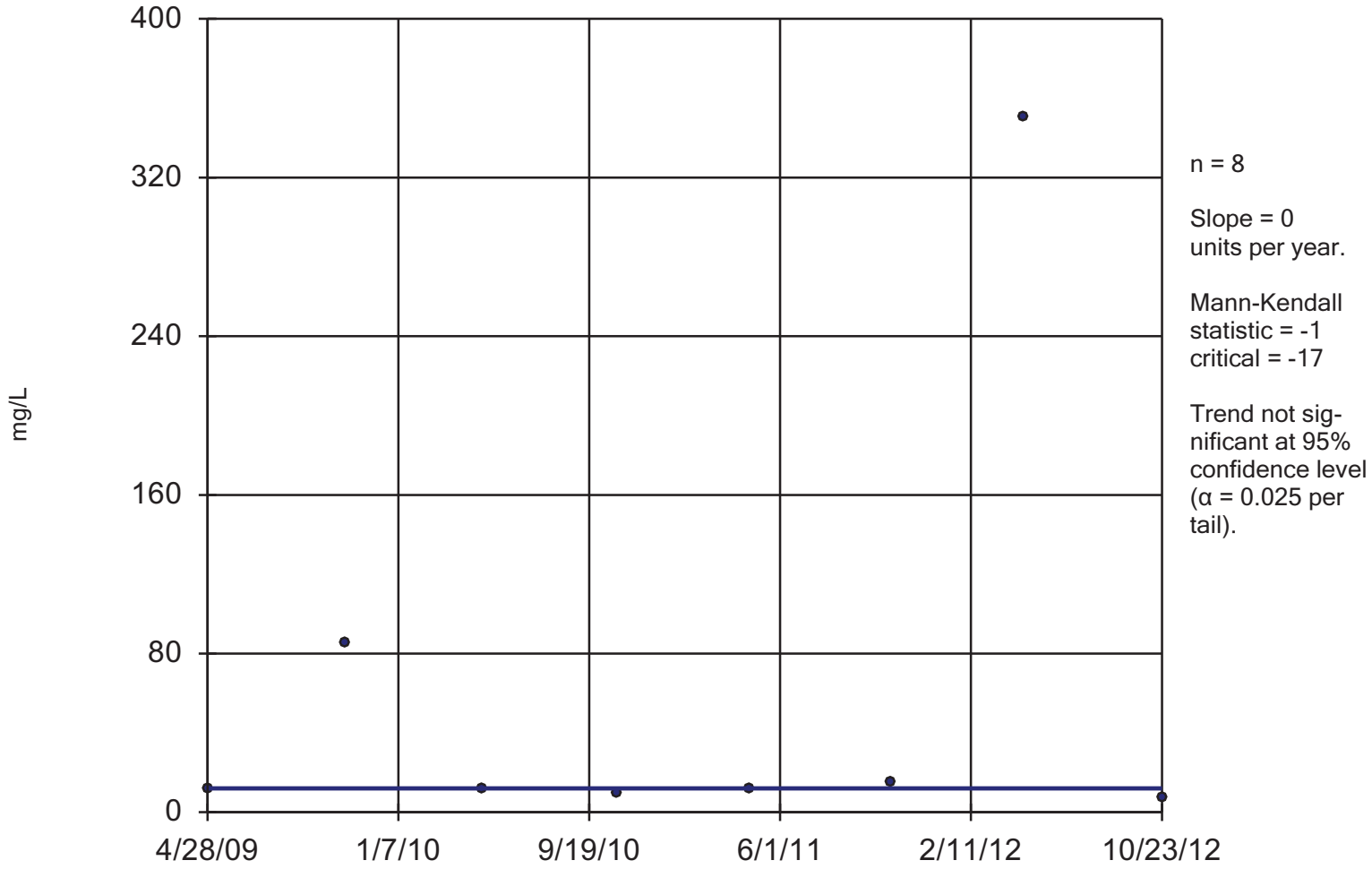



Constituent: Chloride  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-7

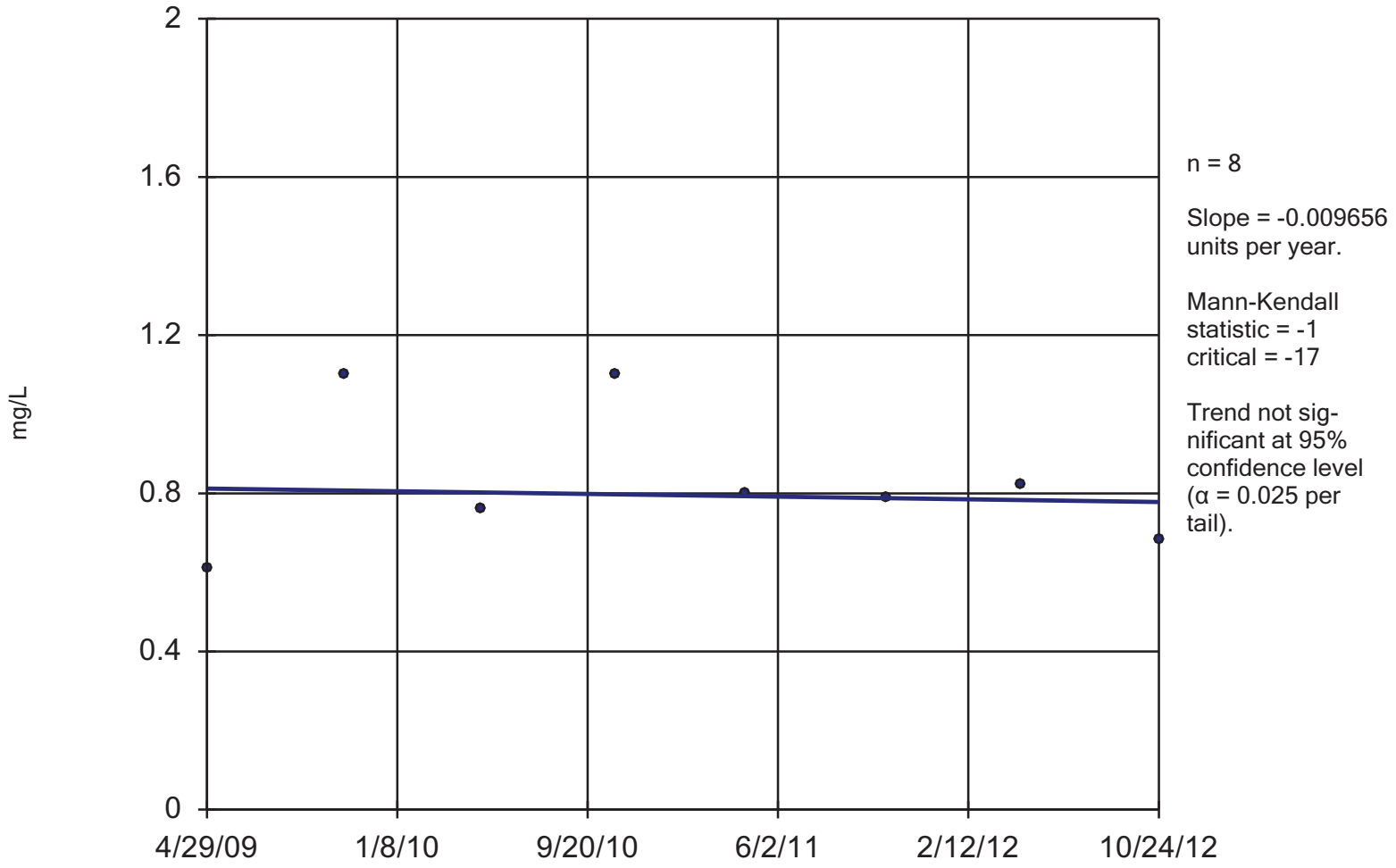



Constituent: Chloride  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-10



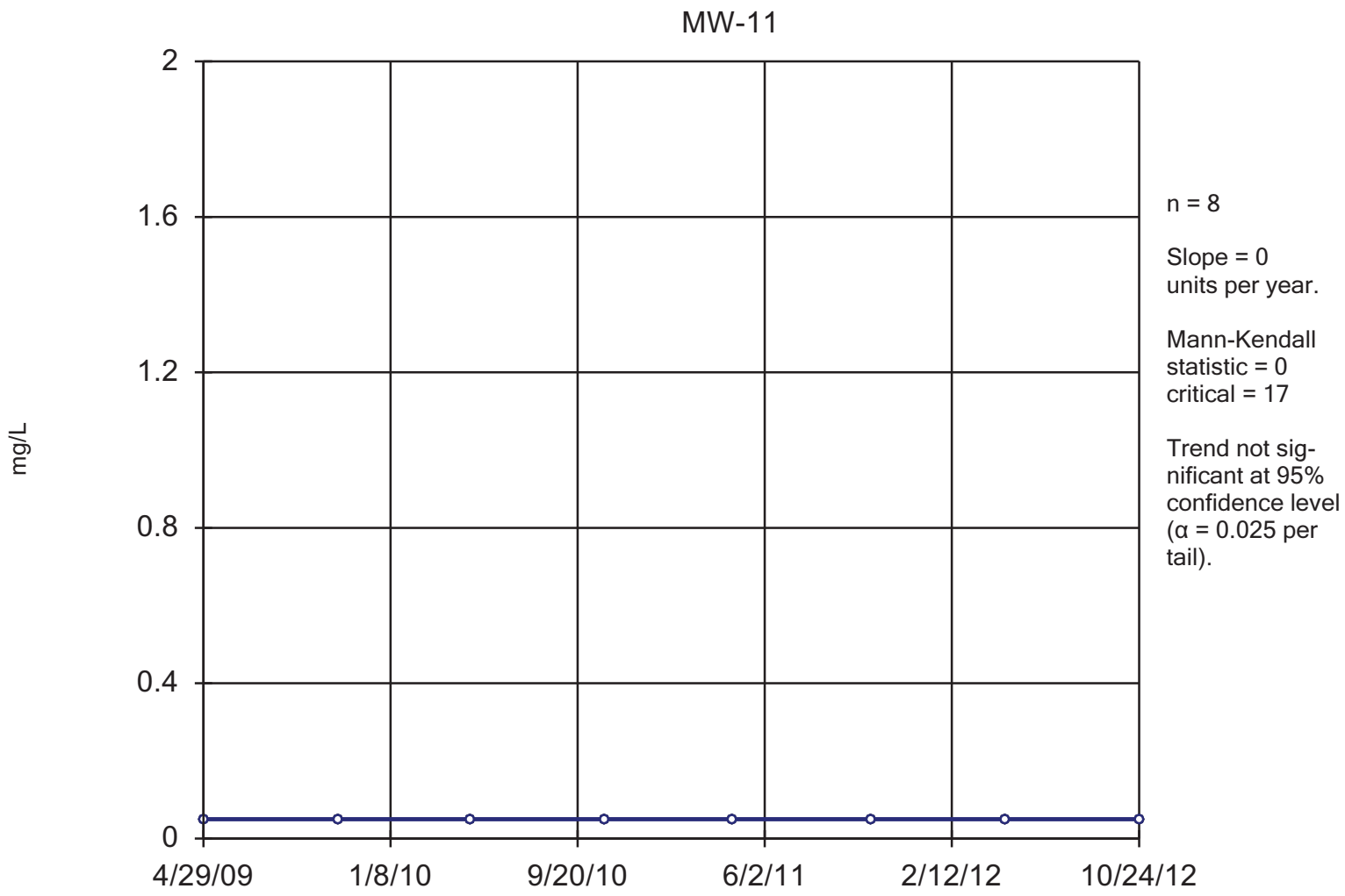

Constituent: Fluoride  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator

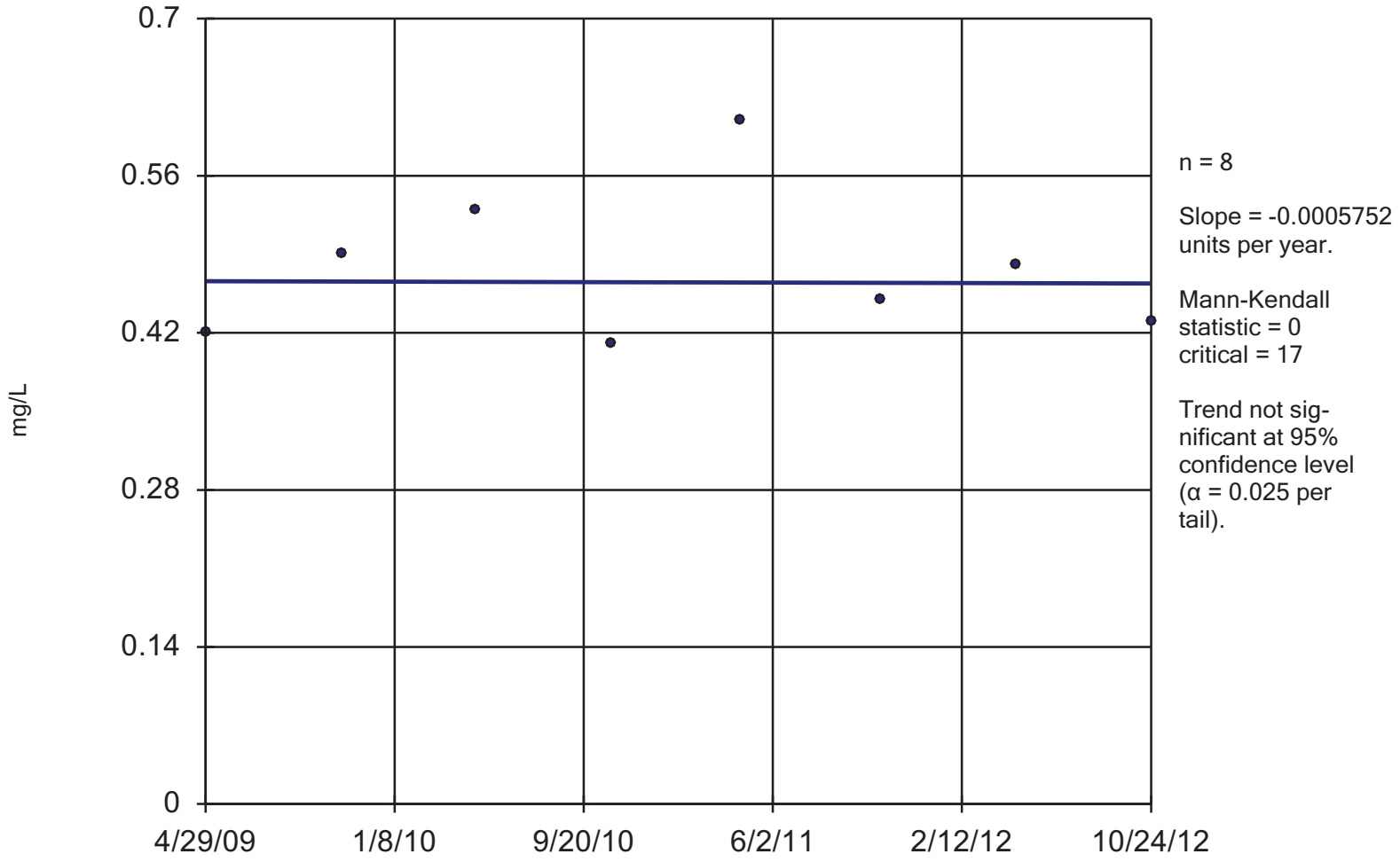



Constituent: Fluoride  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-8




Constituent: Fluoride  Analysis Run 12/14/2012 9:26 AM

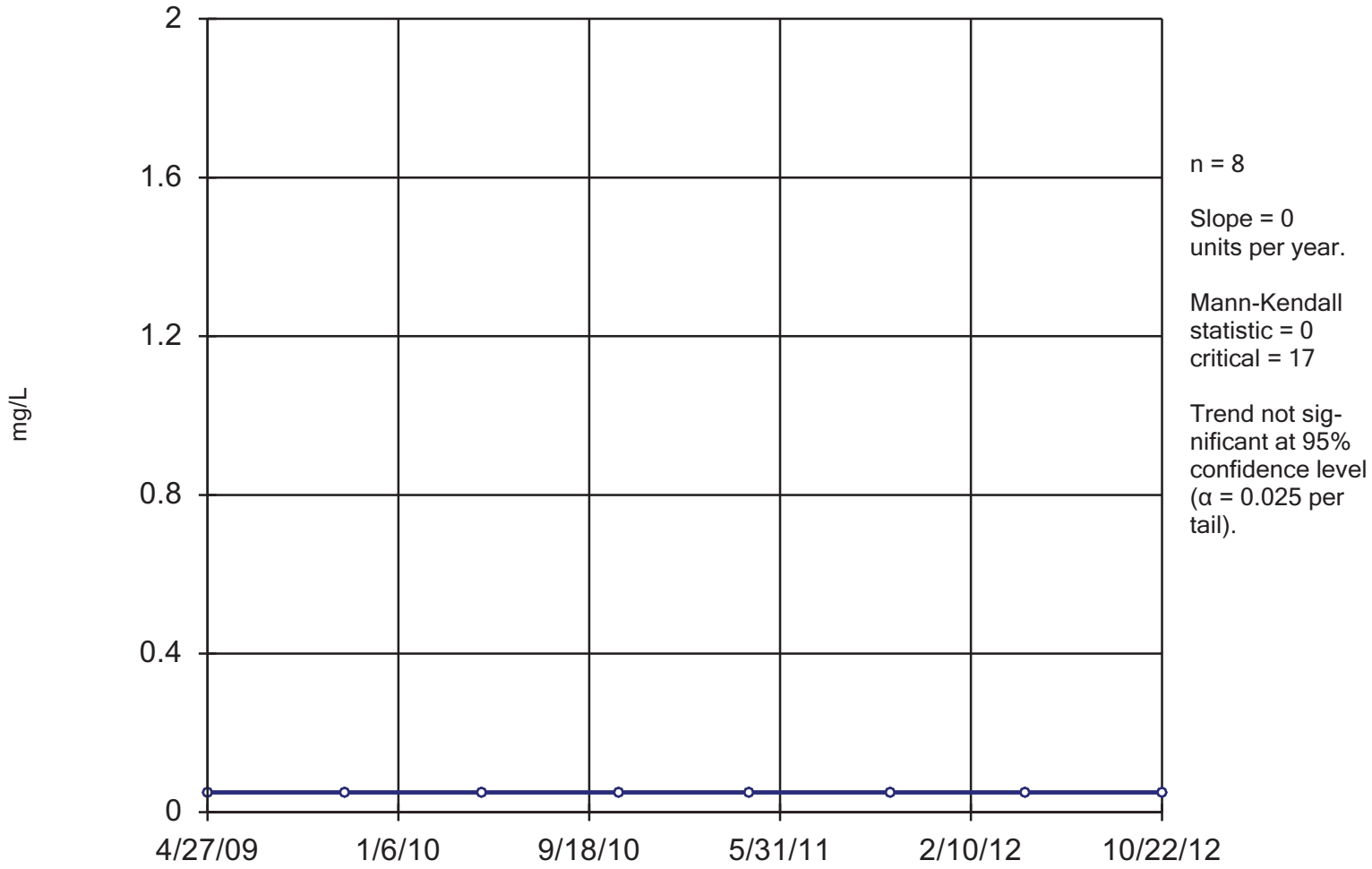
Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator

## MW-13D (bg)



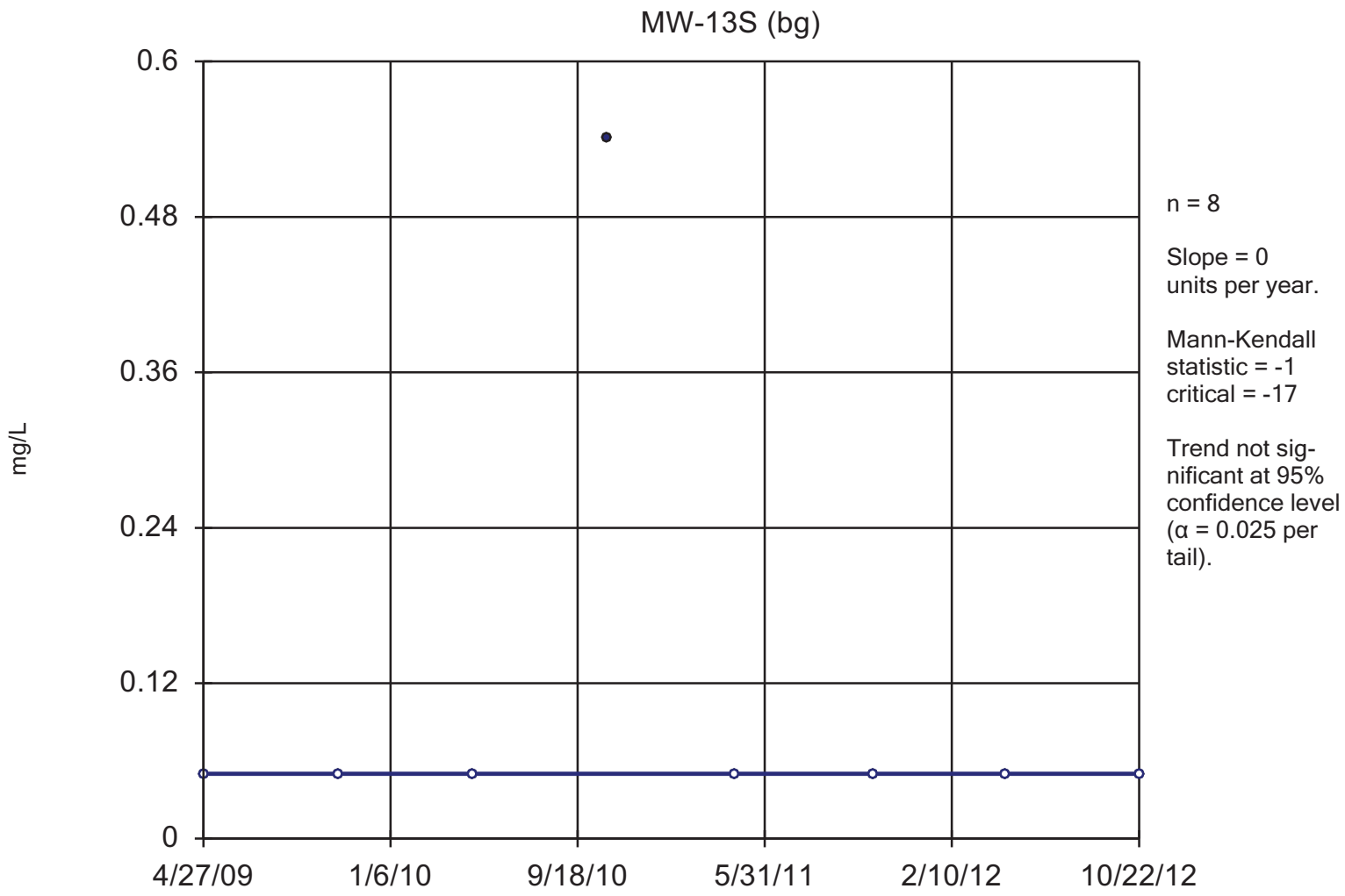

Constituent: Fluoride  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator



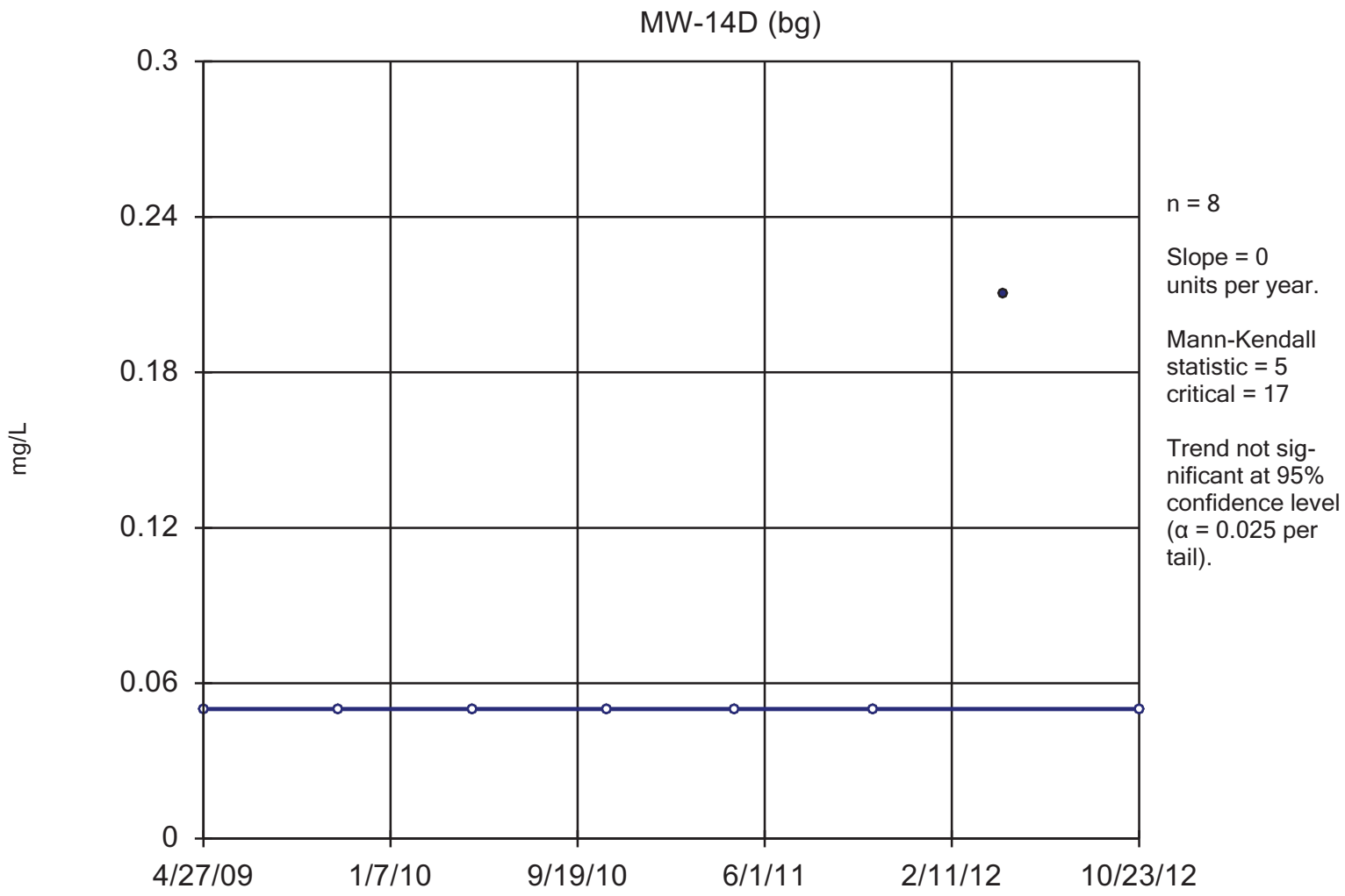

Constituent: Fluoride  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator

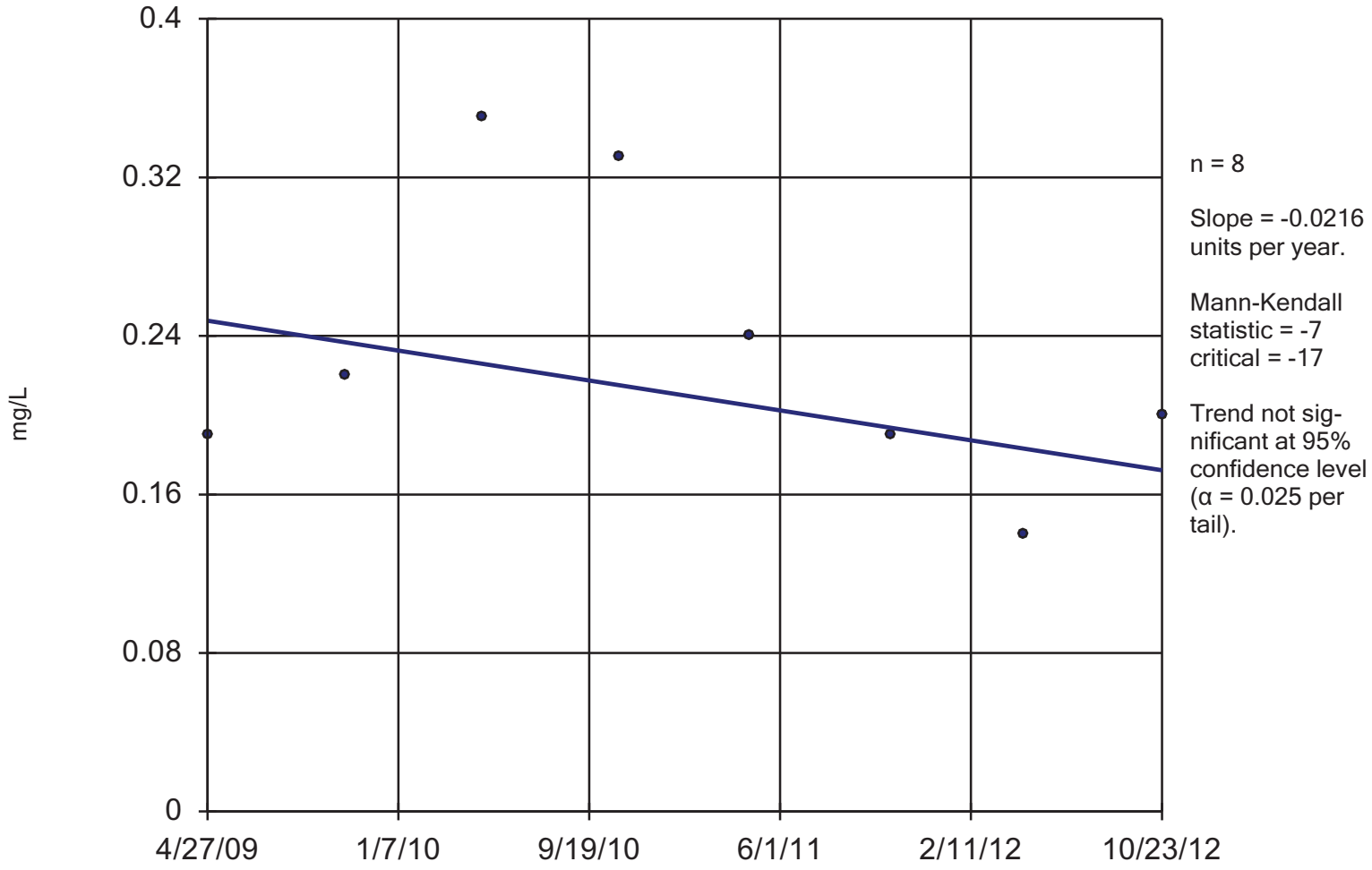



Constituent: Fluoride  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-14S (bg)



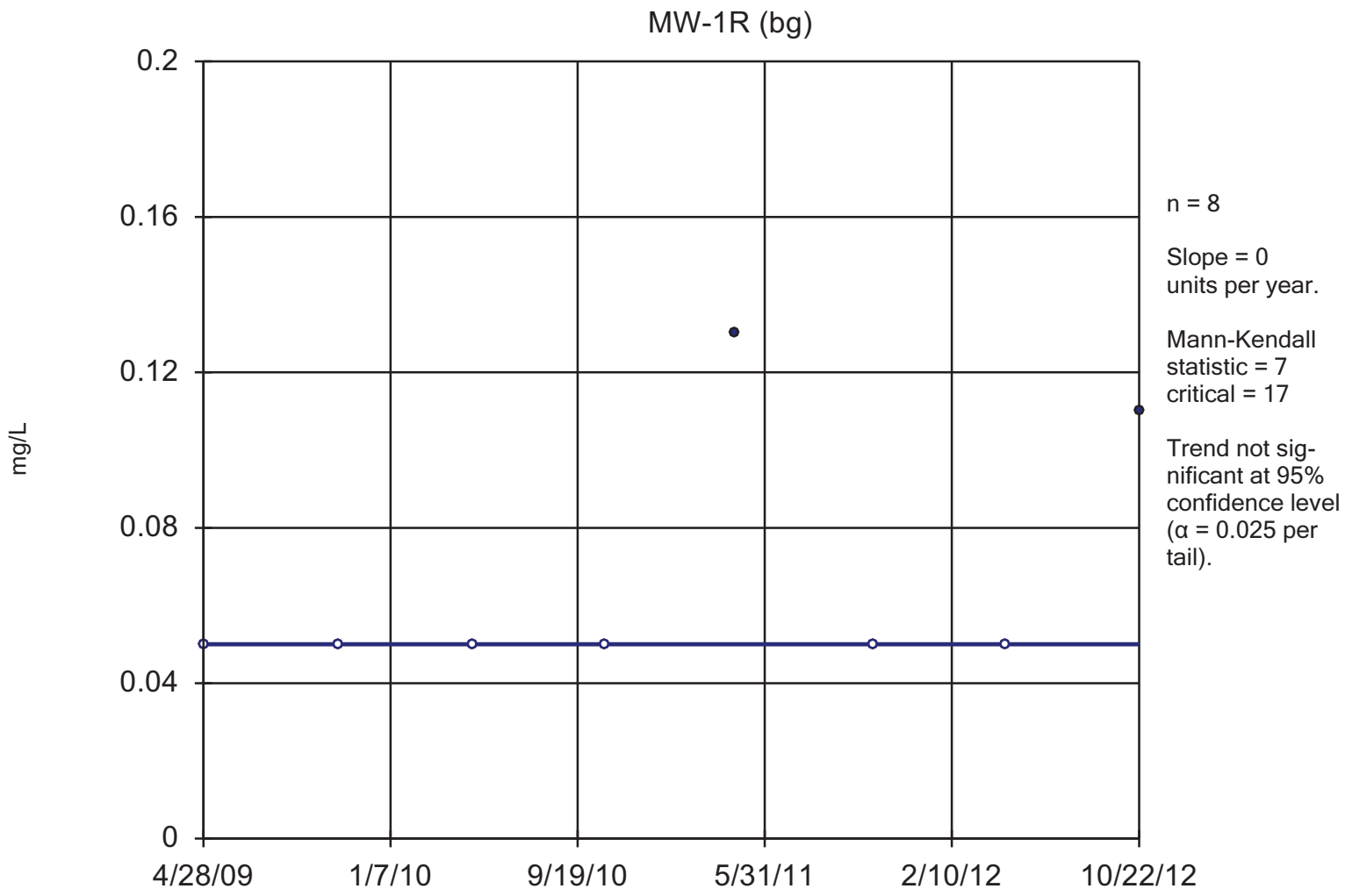

Constituent: Fluoride  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator



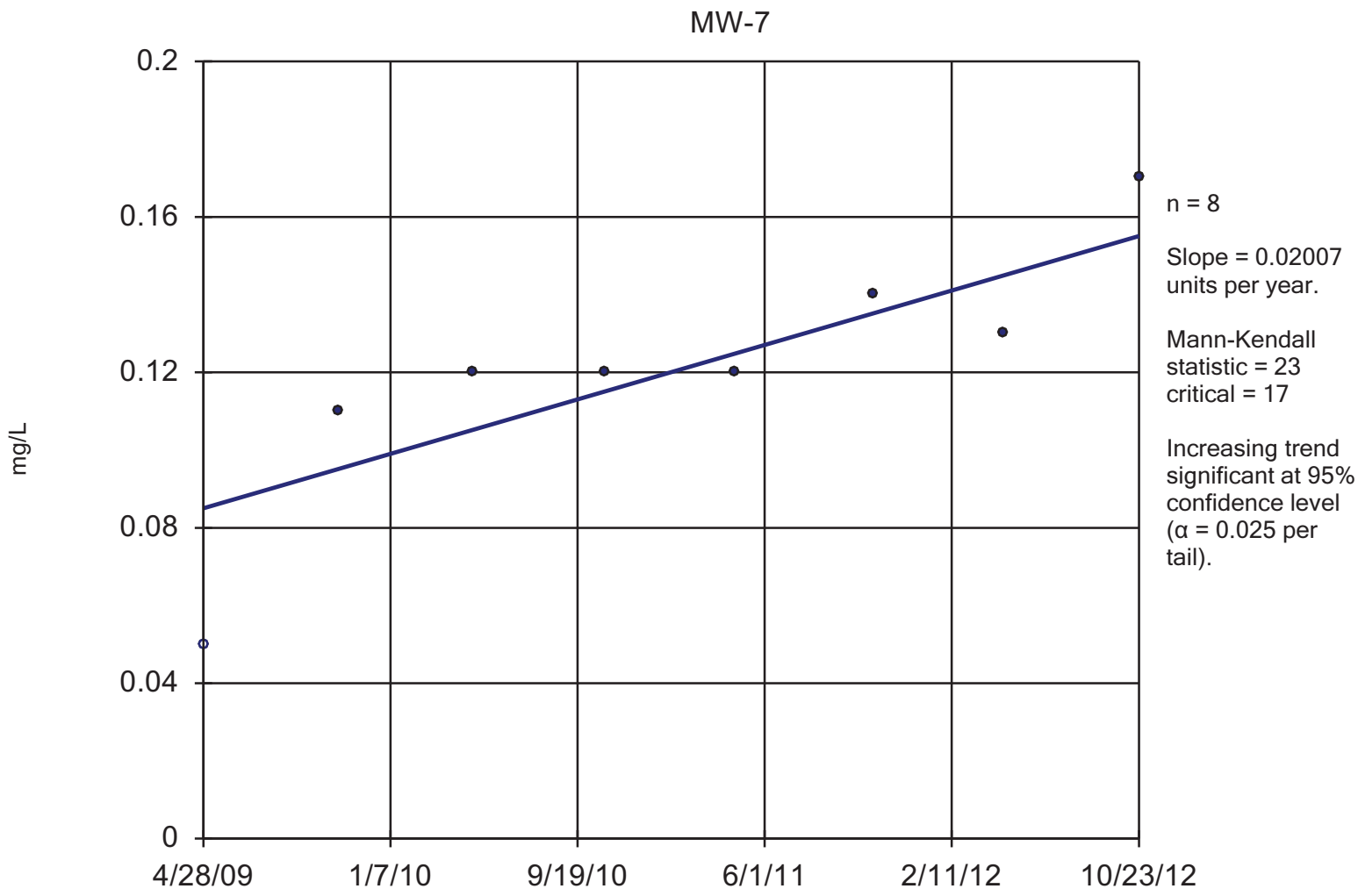

Constituent: Fluoride  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator



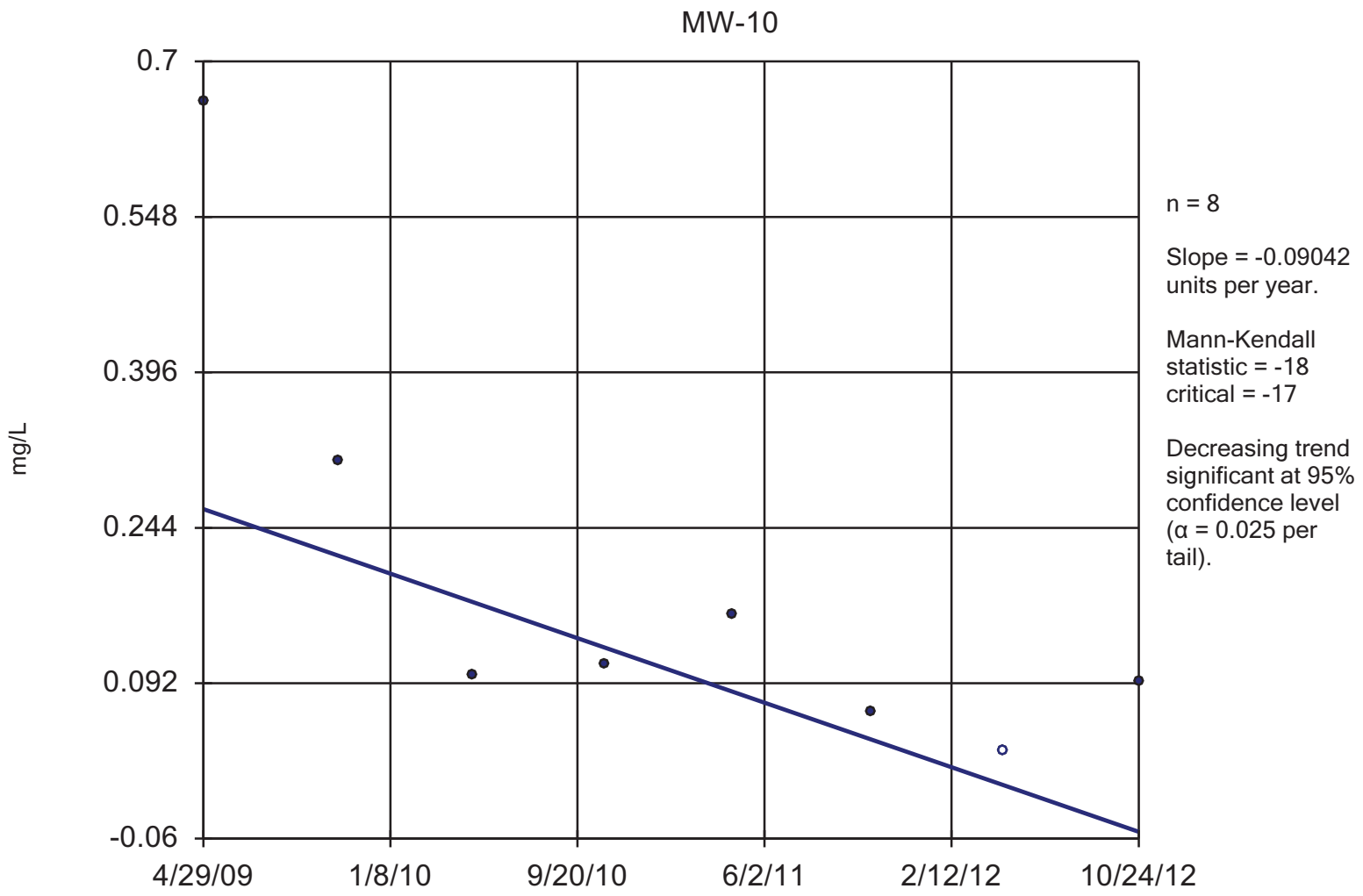

Constituent: Fluoride  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator

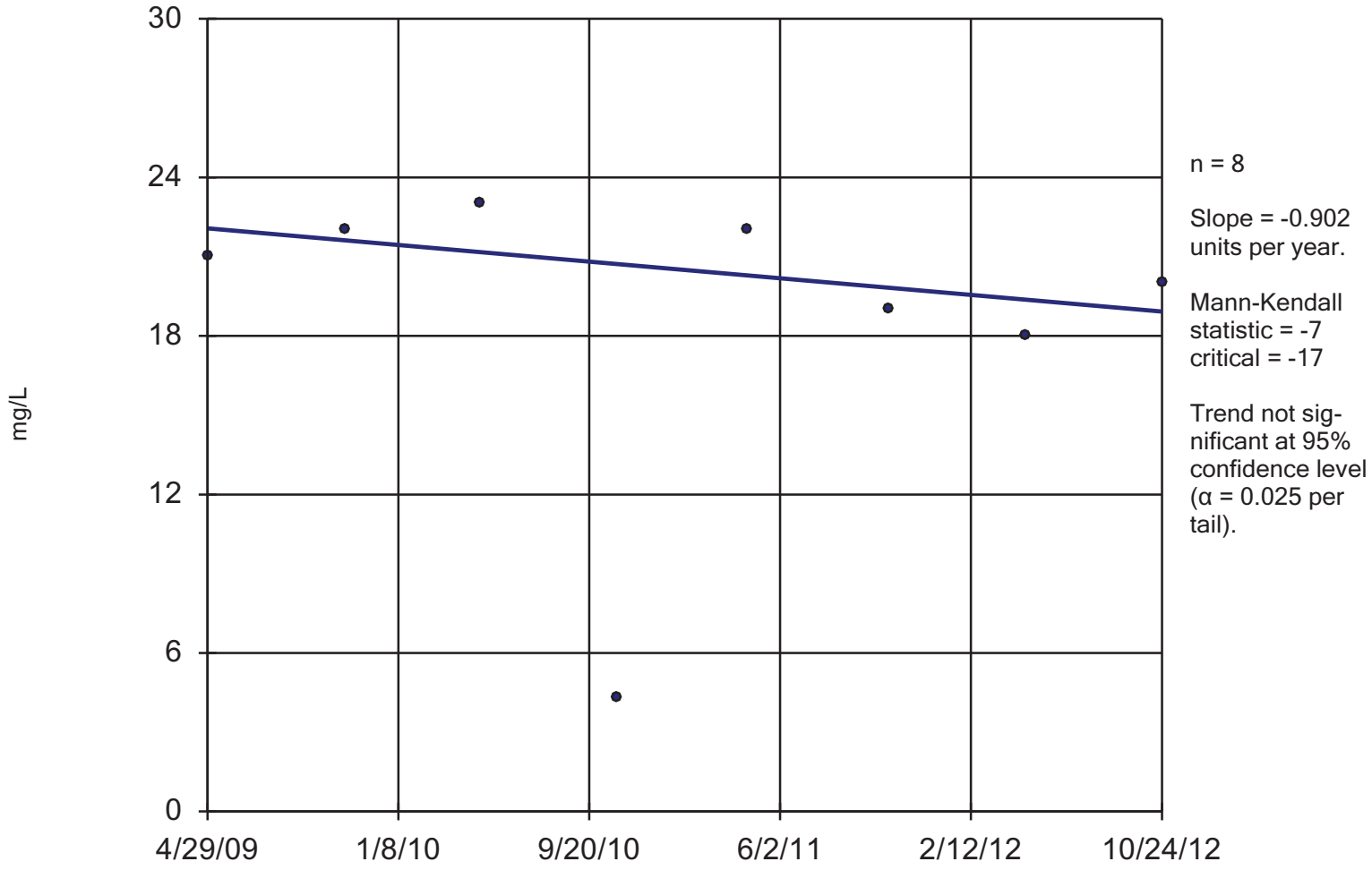



Constituent: Iron, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-11



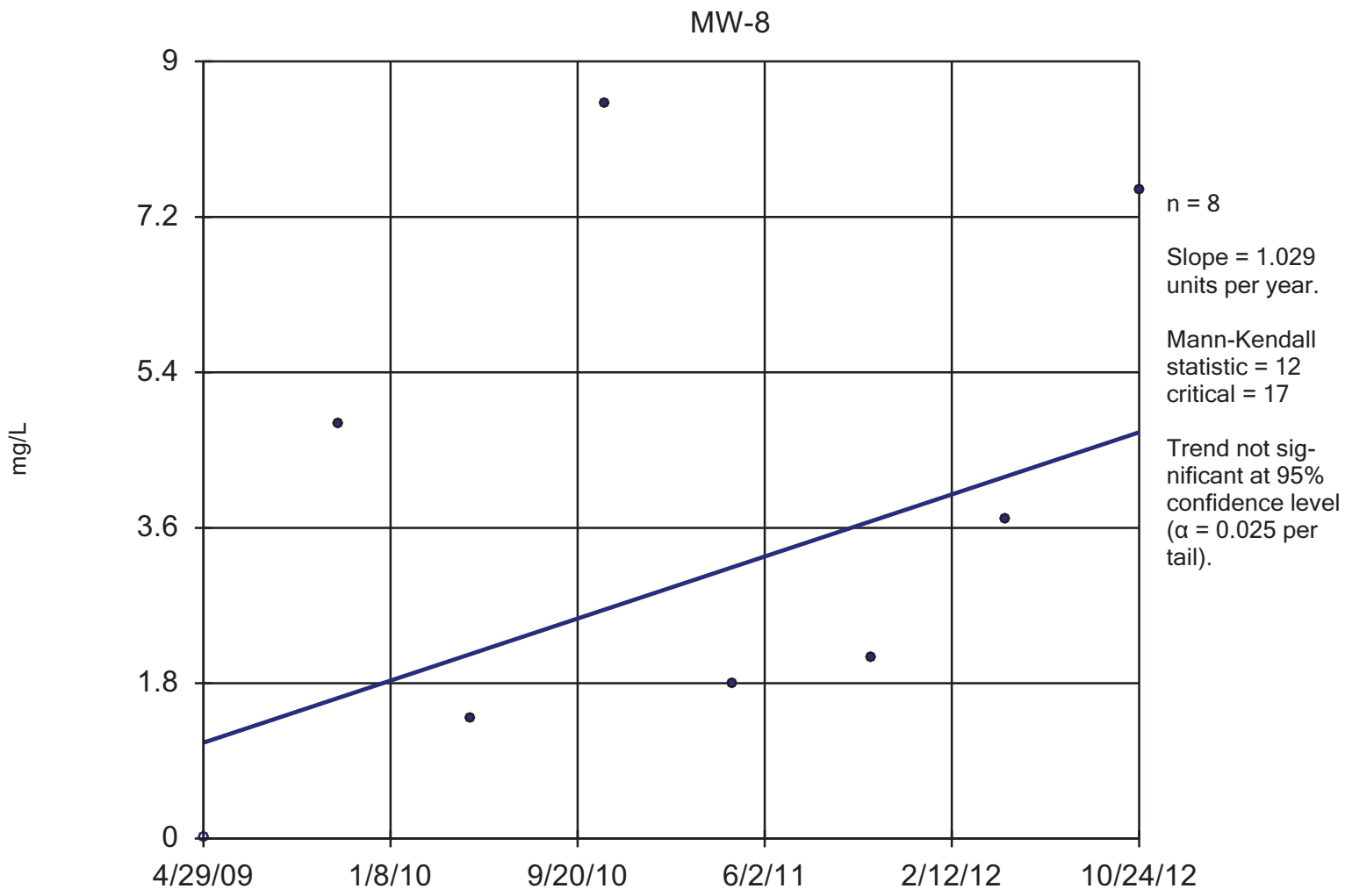

Constituent: Iron, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator

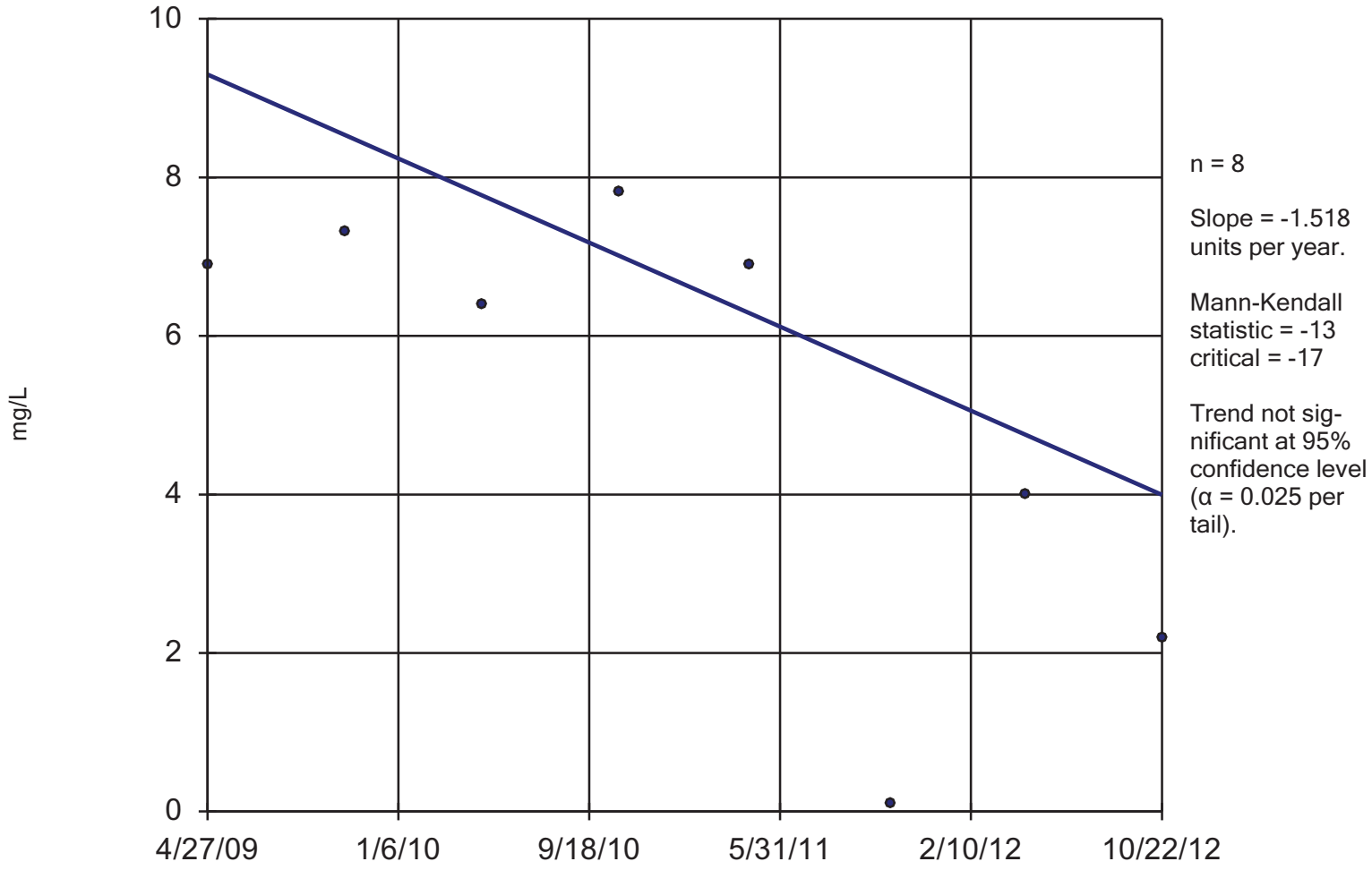



Constituent: Iron, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-13D (bg)

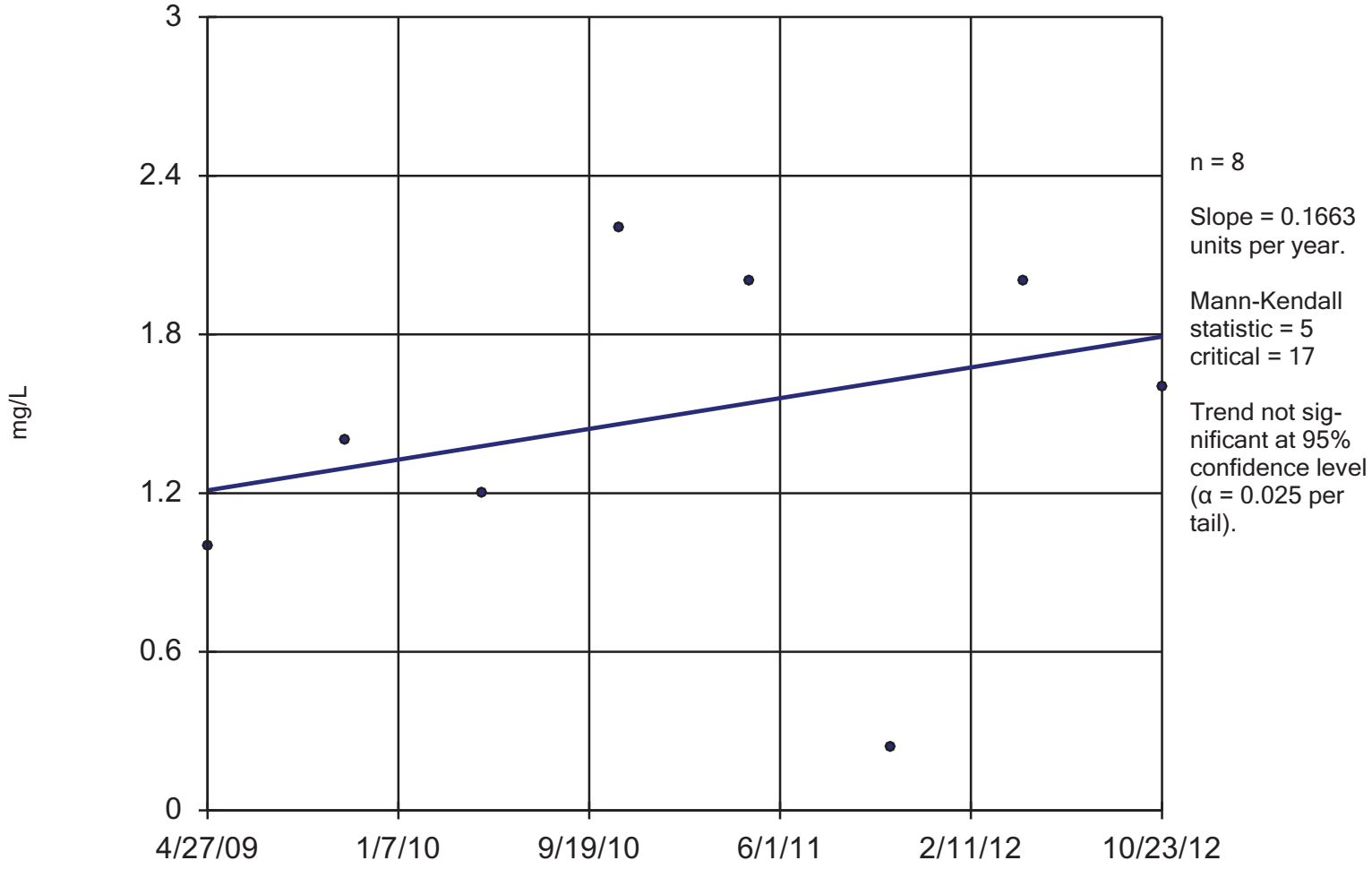



Constituent: Iron, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-14D (bg)




Constituent: Iron, dissolved  Analysis Run 12/14/2012 9:26 AM

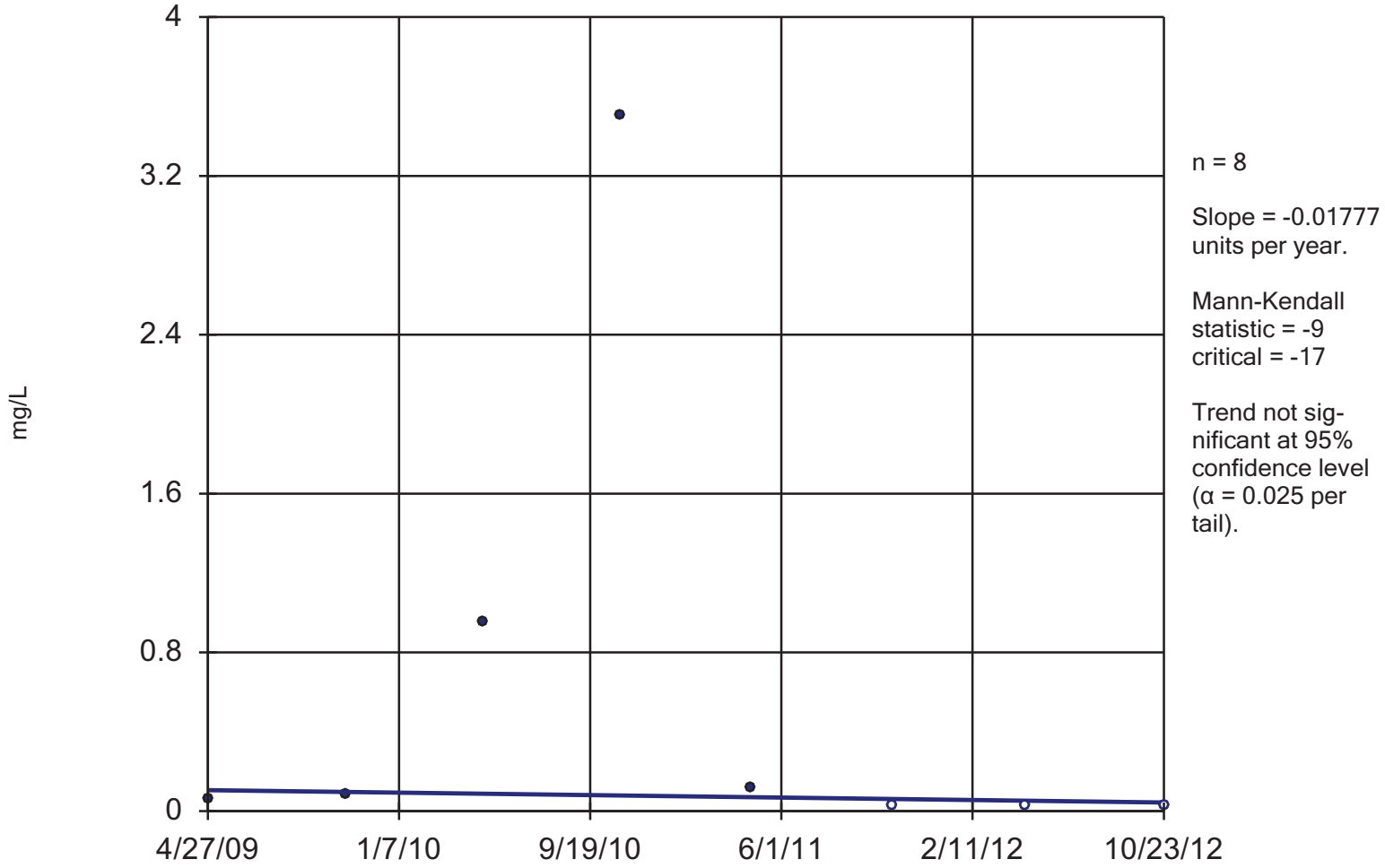
Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator

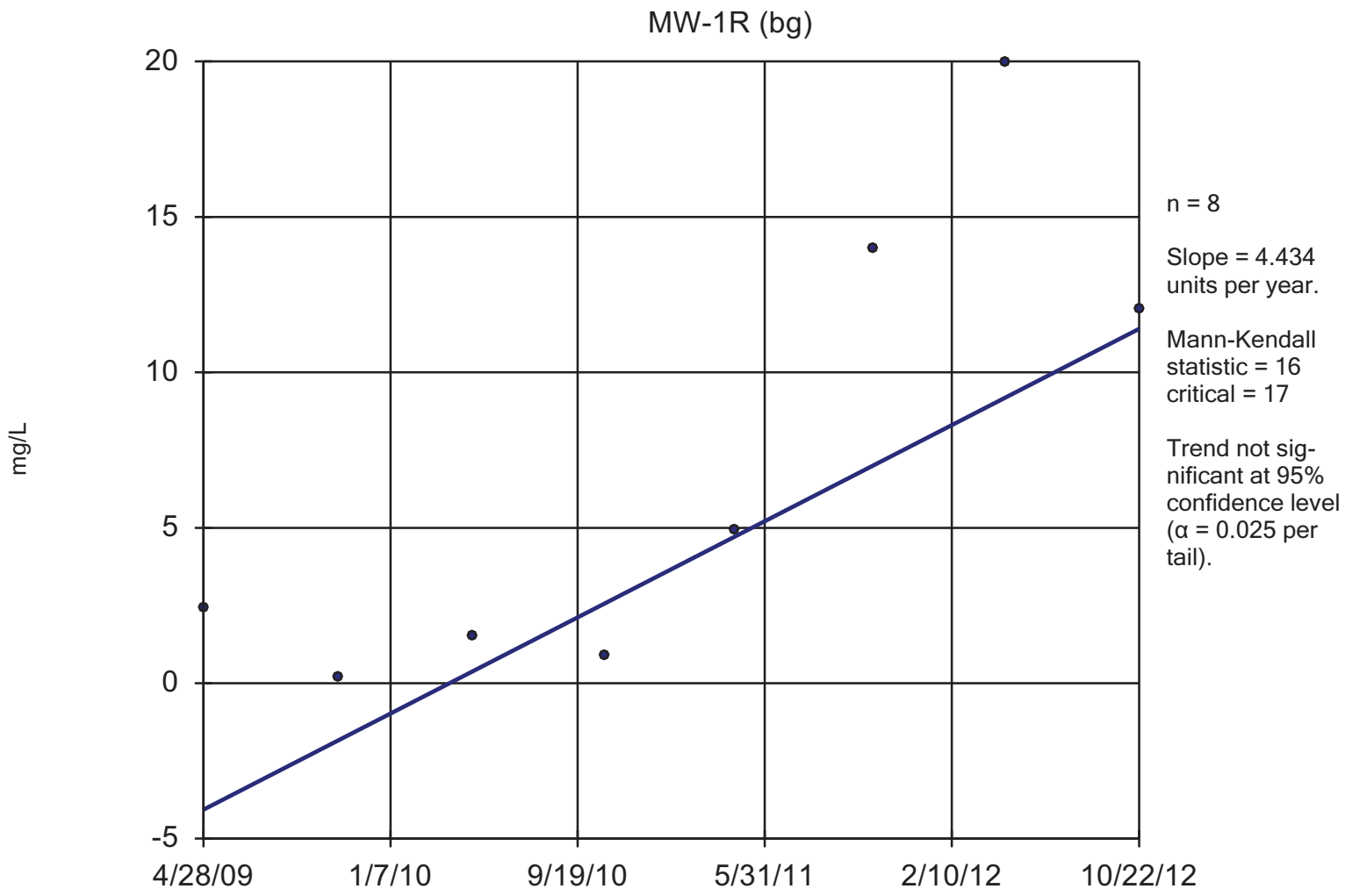
## MW-14S (bg)




Constituent: Iron, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

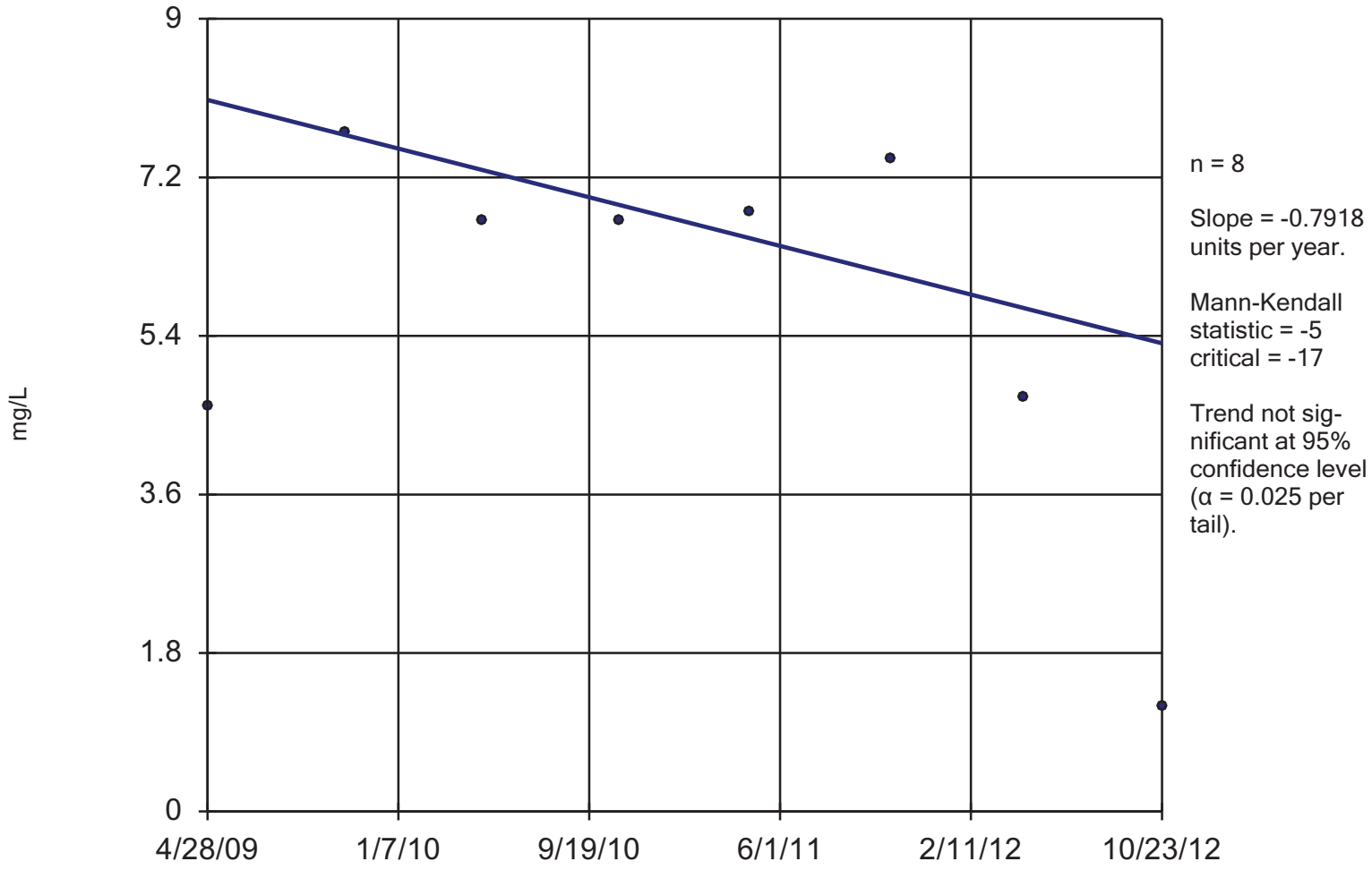



Constituent: Iron, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-6

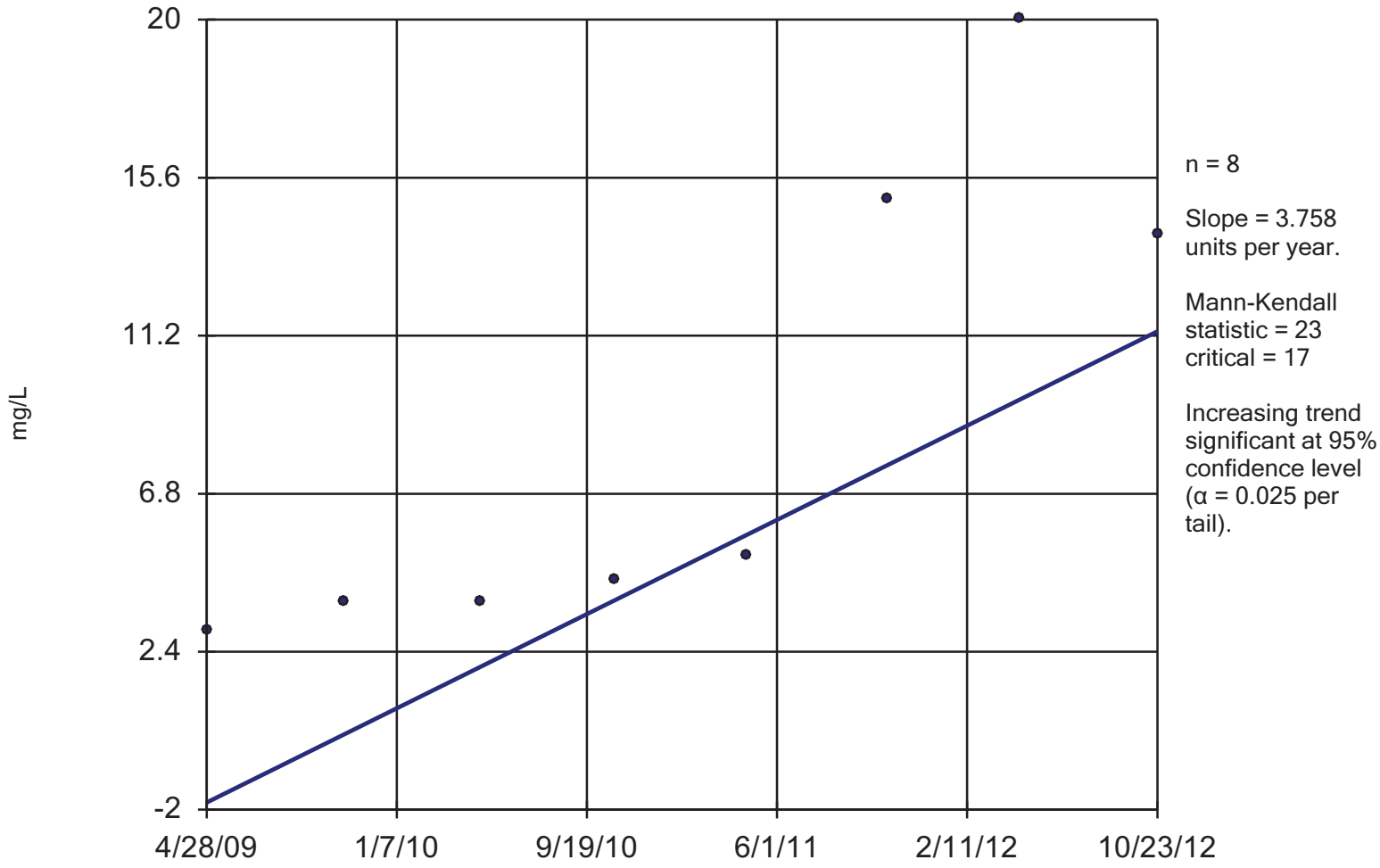



Constituent: Iron, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-7

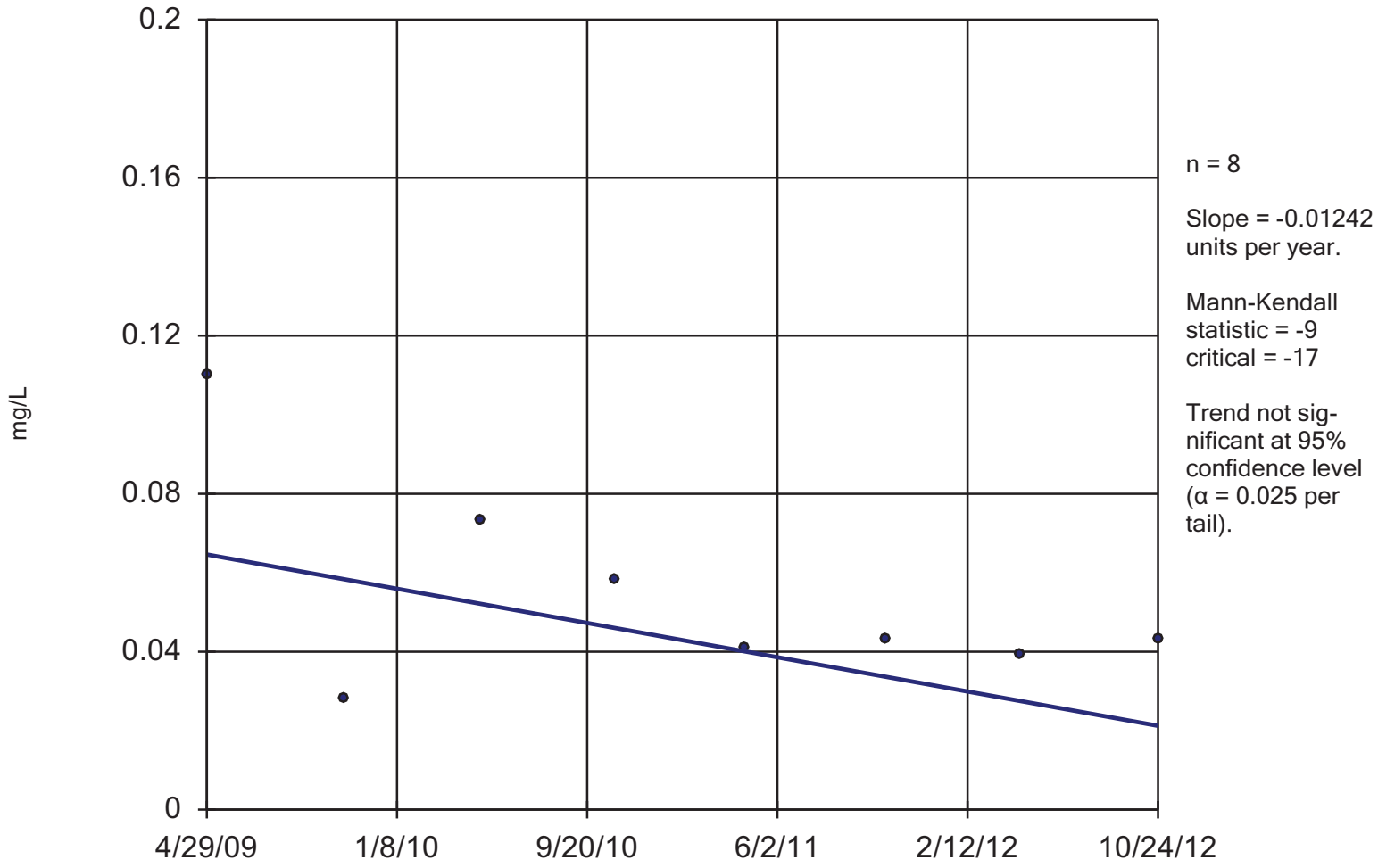



Constituent: Iron, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-10

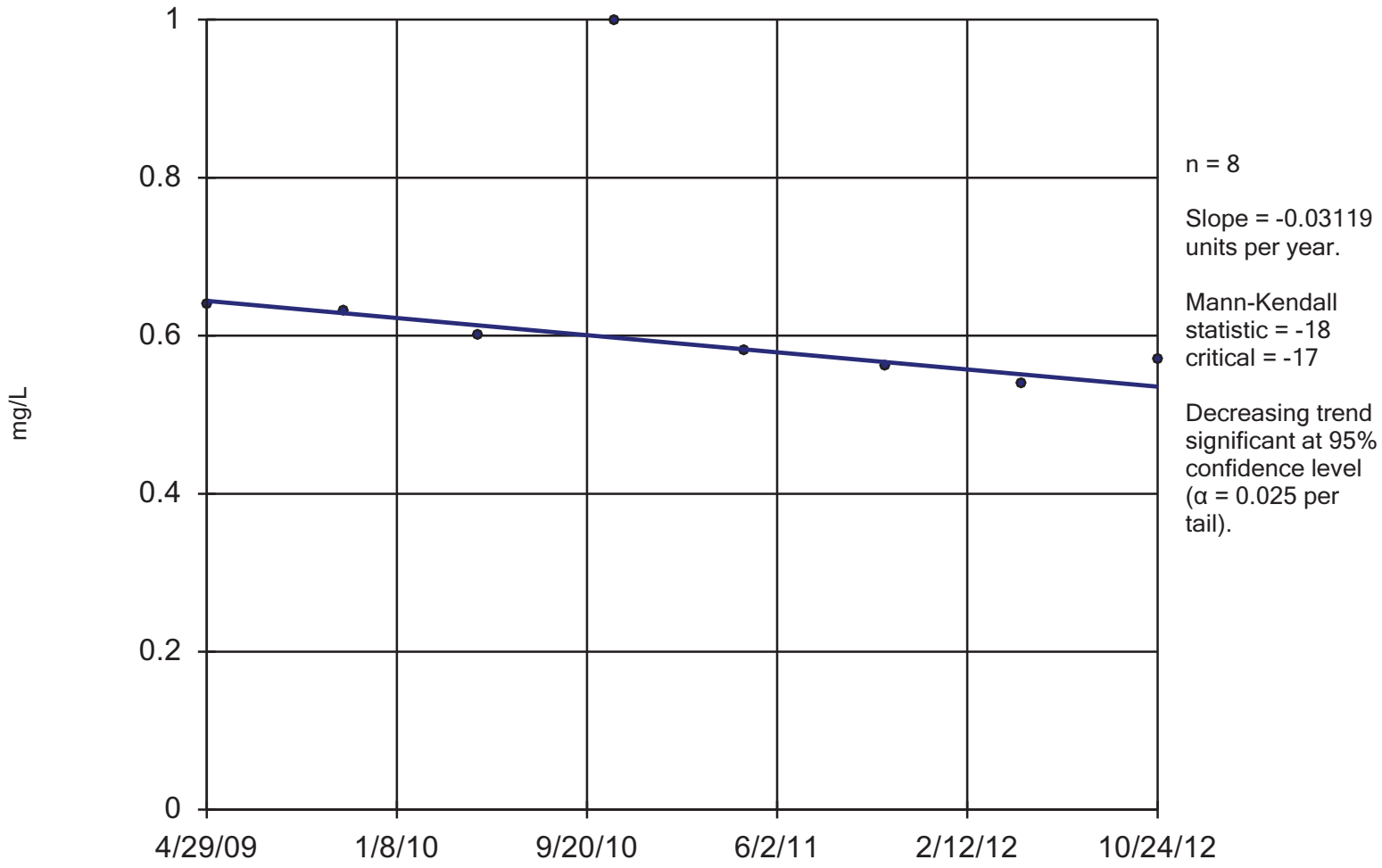



Constituent: Manganese, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-11

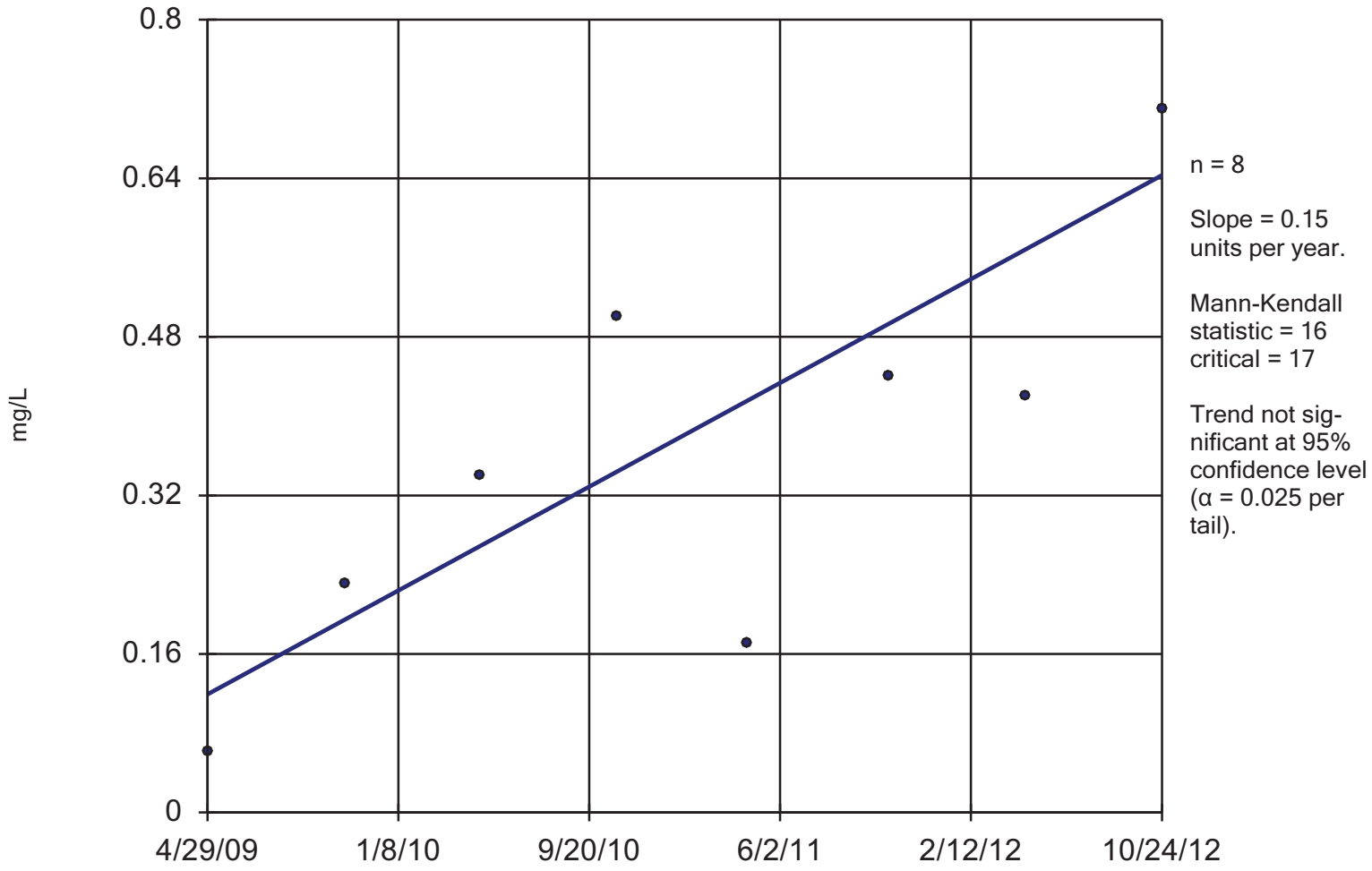



Constituent: Manganese, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

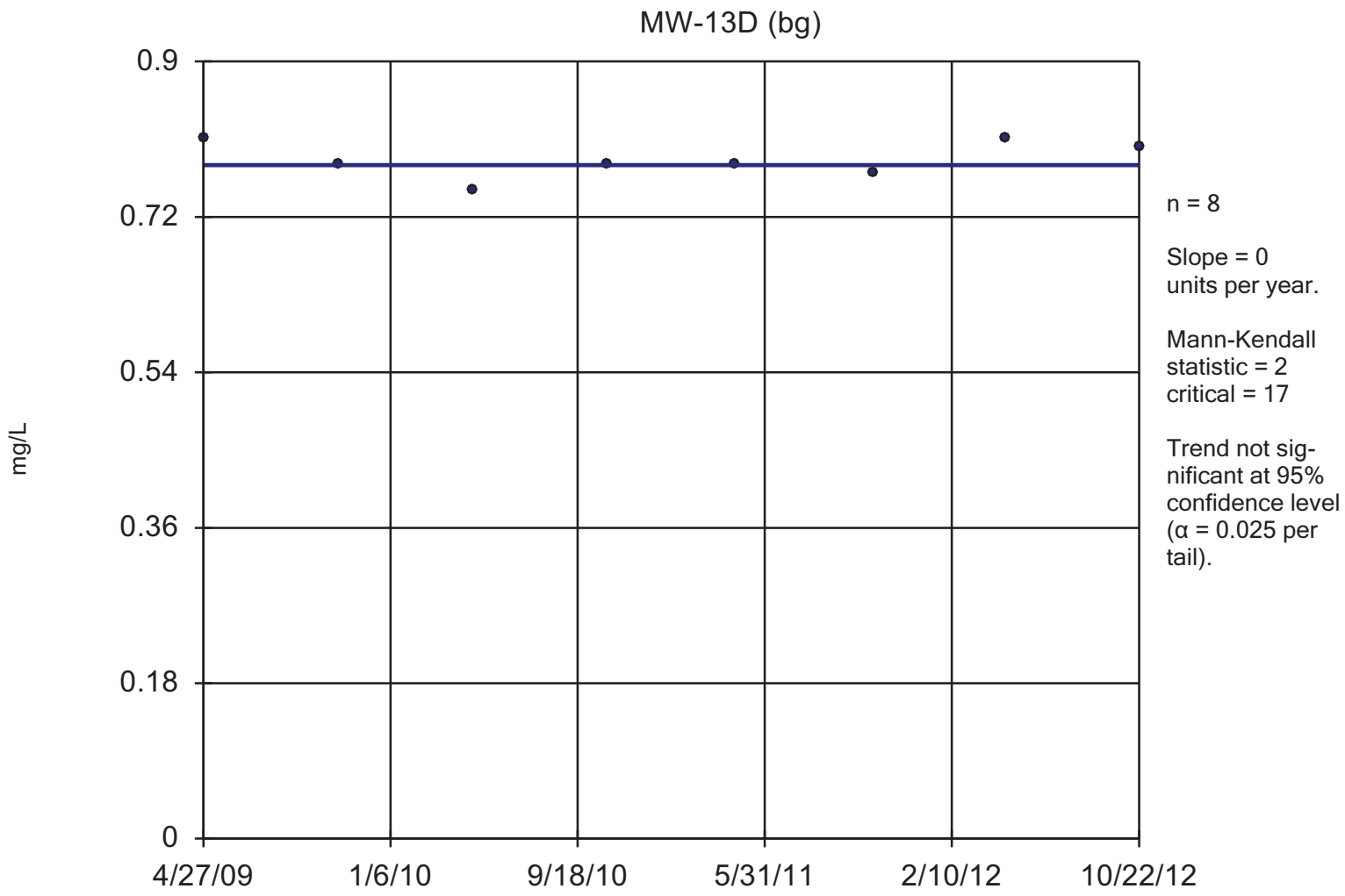
## MW-8




Constituent: Manganese, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

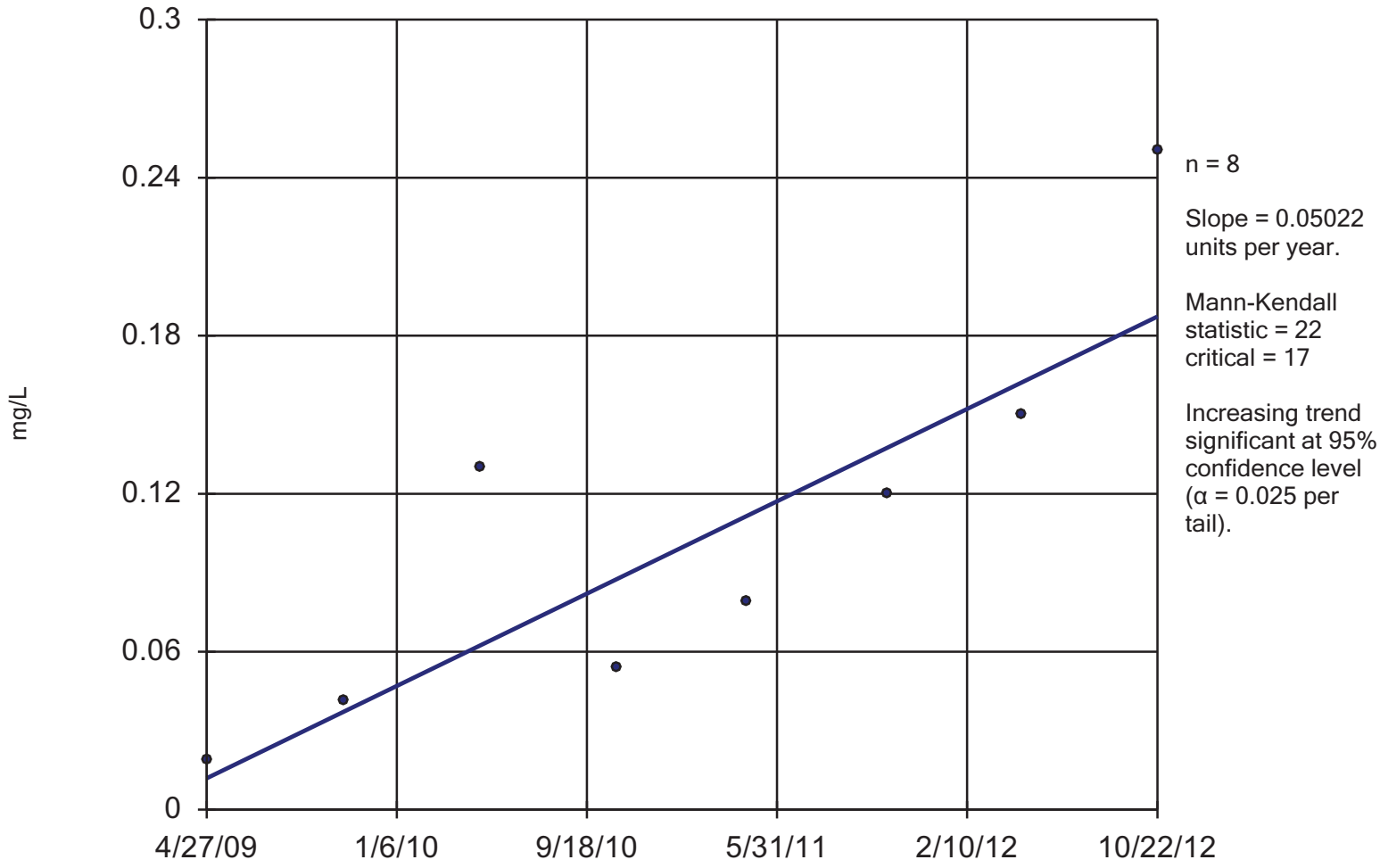



Constituent: Manganese, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

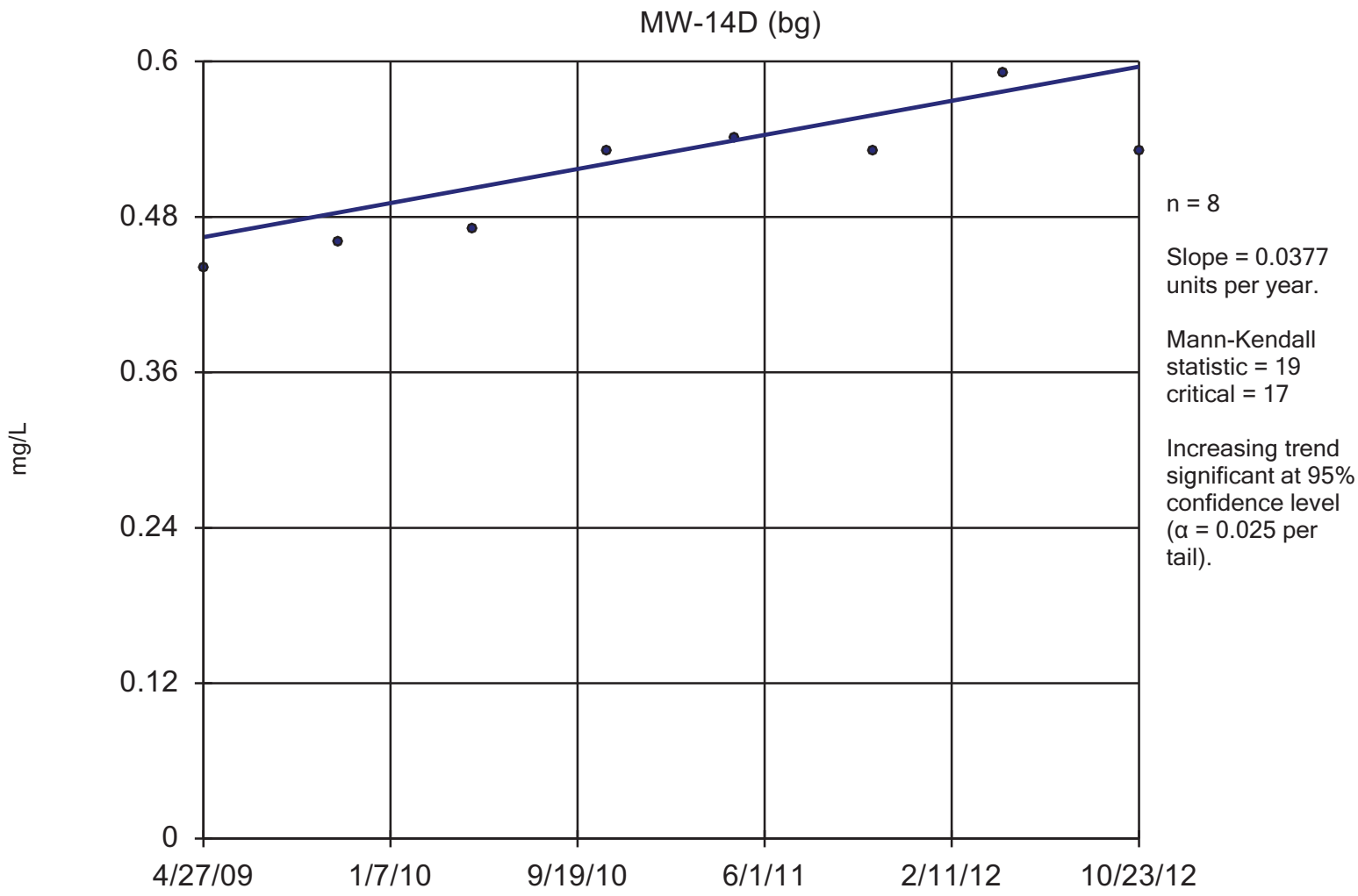
## MW-13S (bg)




Constituent: Manganese, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator



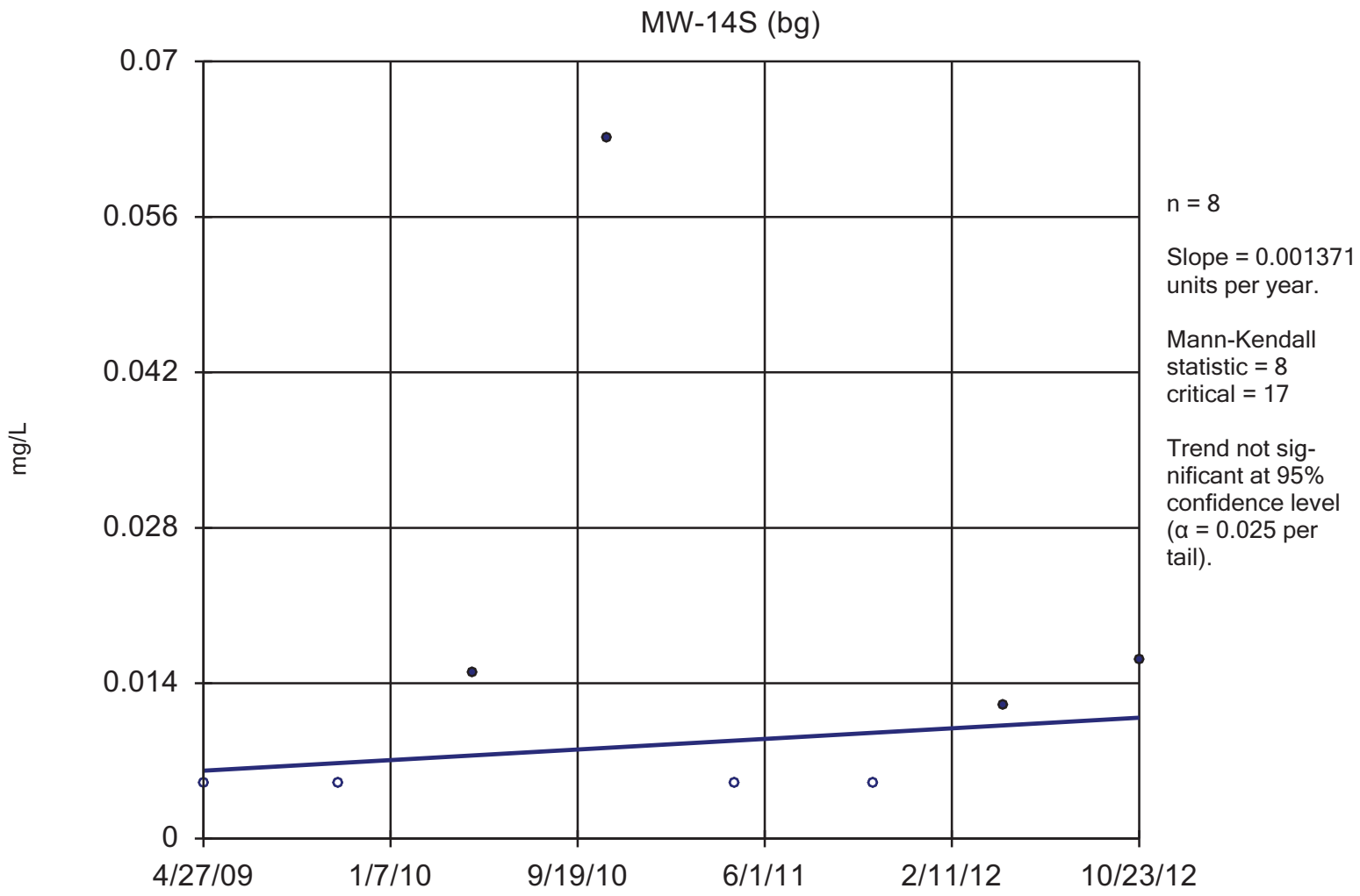

Constituent: Manganese, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator

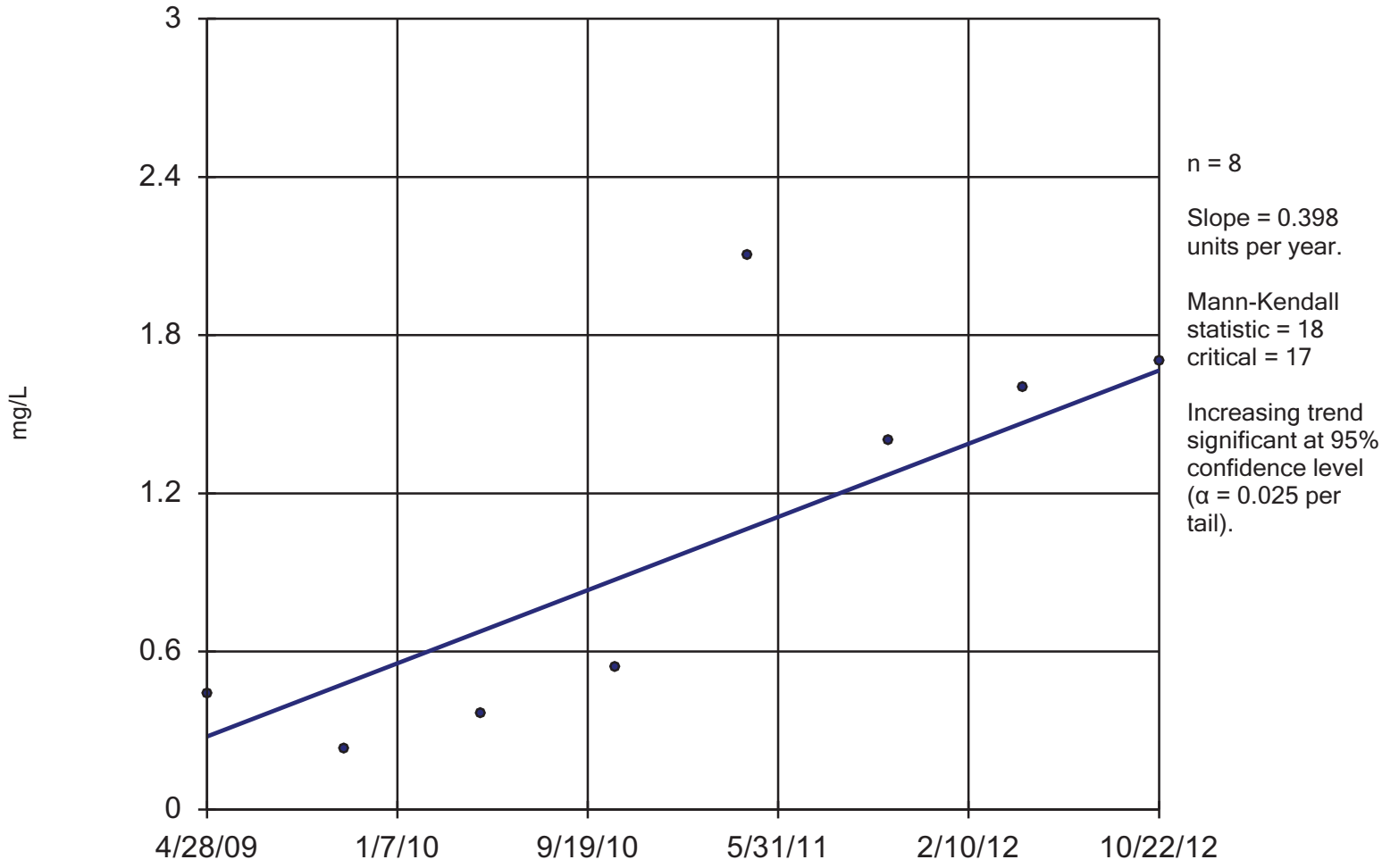



Constituent: Manganese, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-1R (bg)

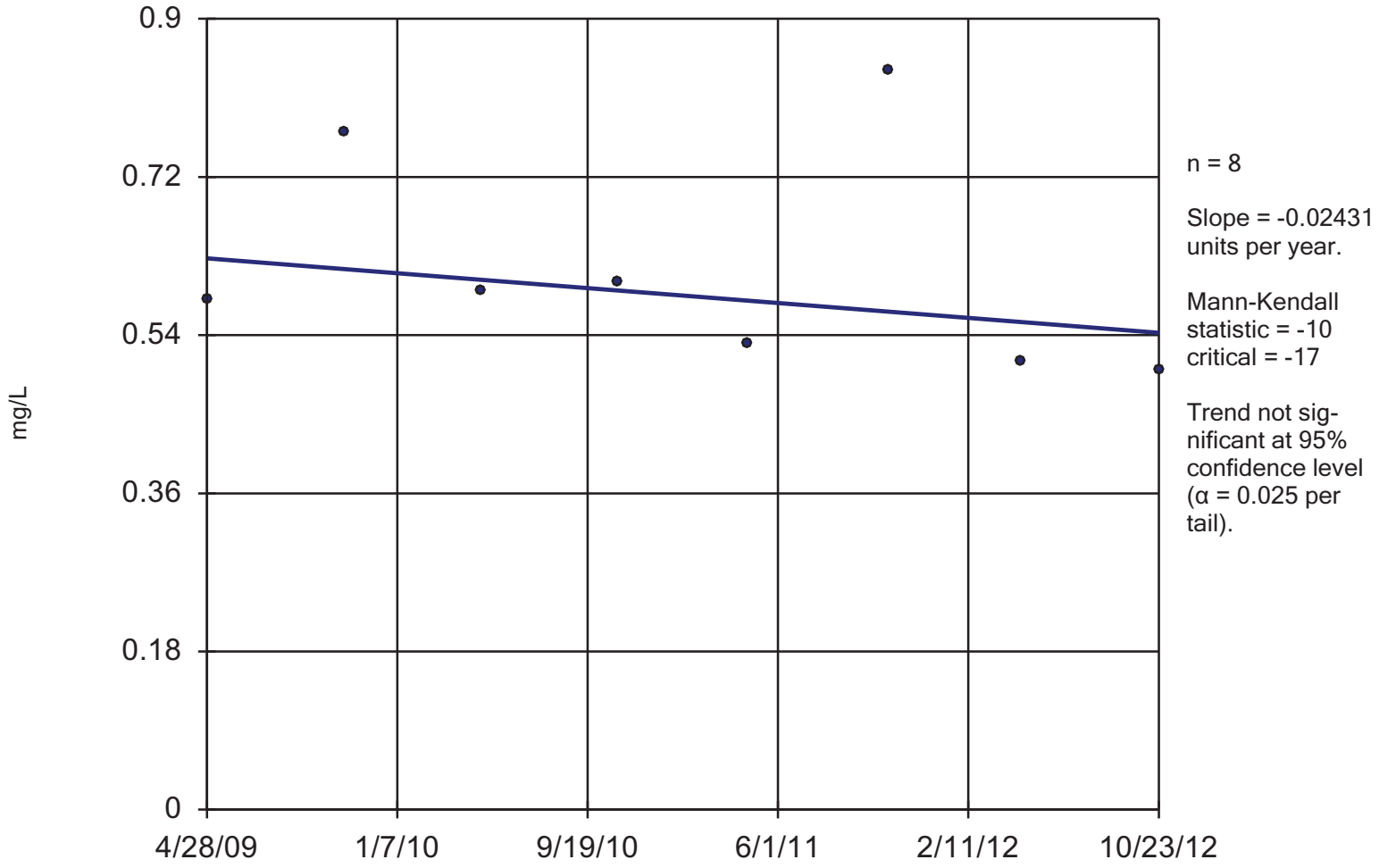



Constituent: Manganese, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-6

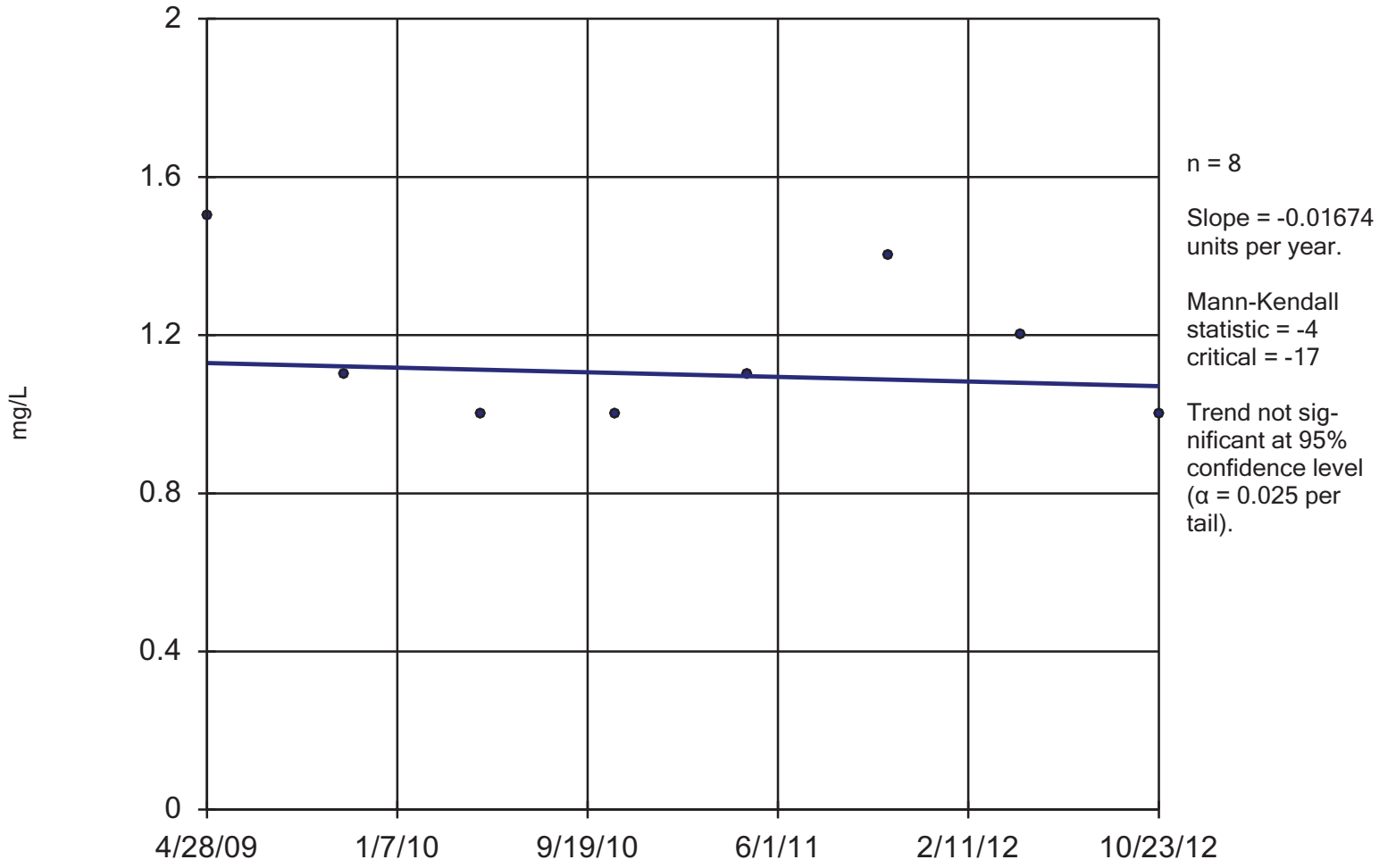



Constituent: Manganese, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-7

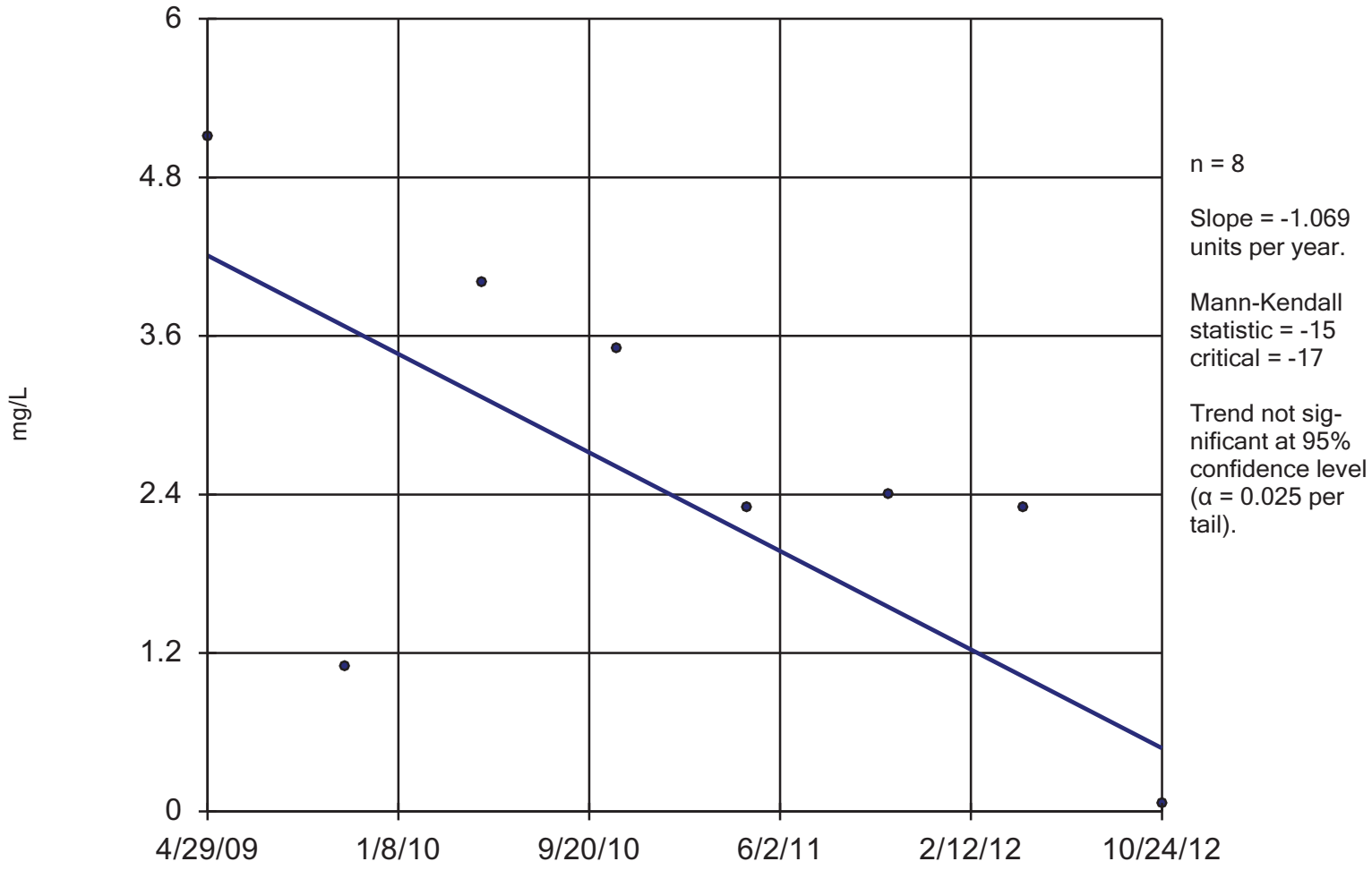



Constituent: Manganese, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-10



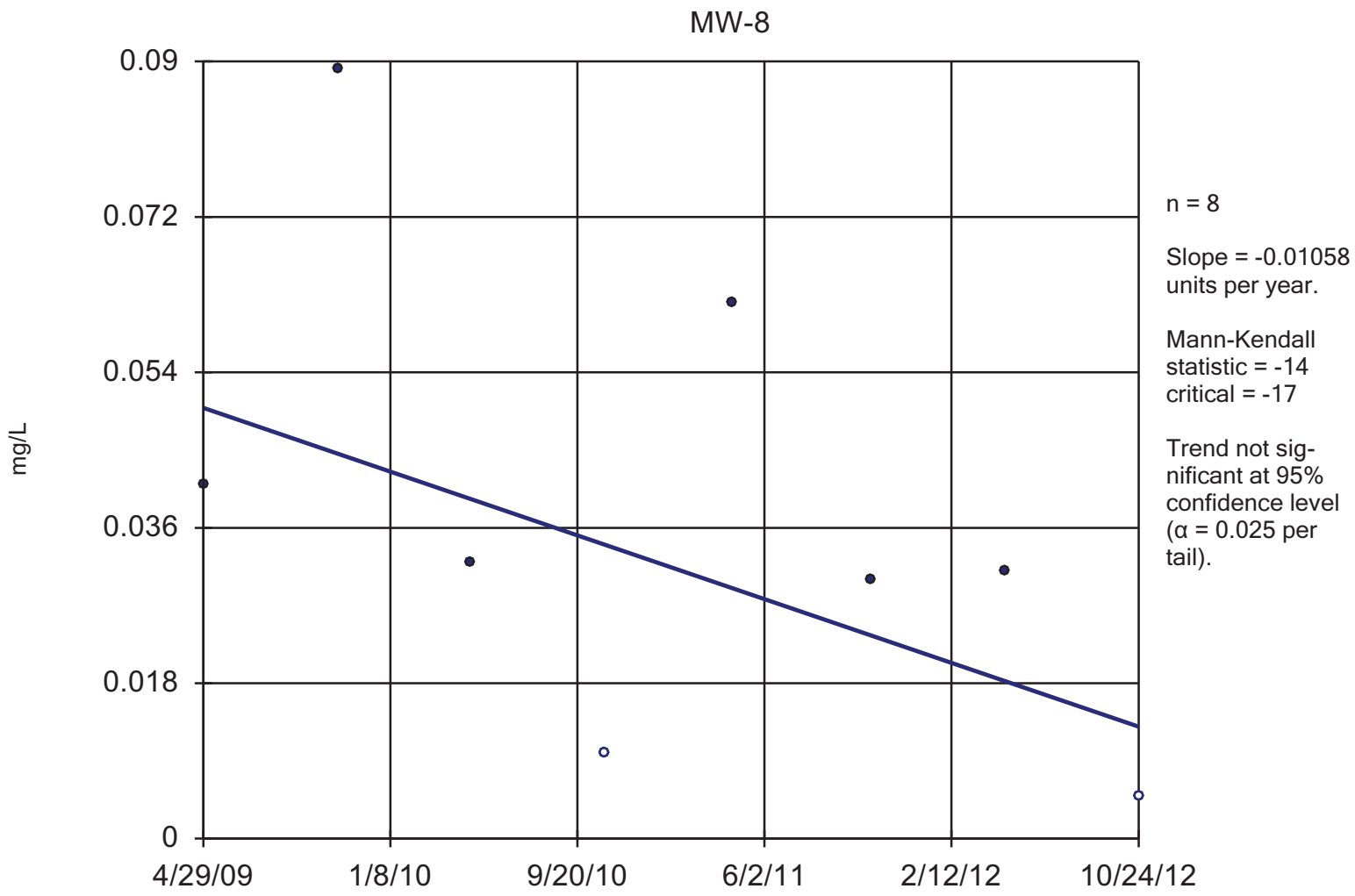

Constituent: Molybdenum, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator



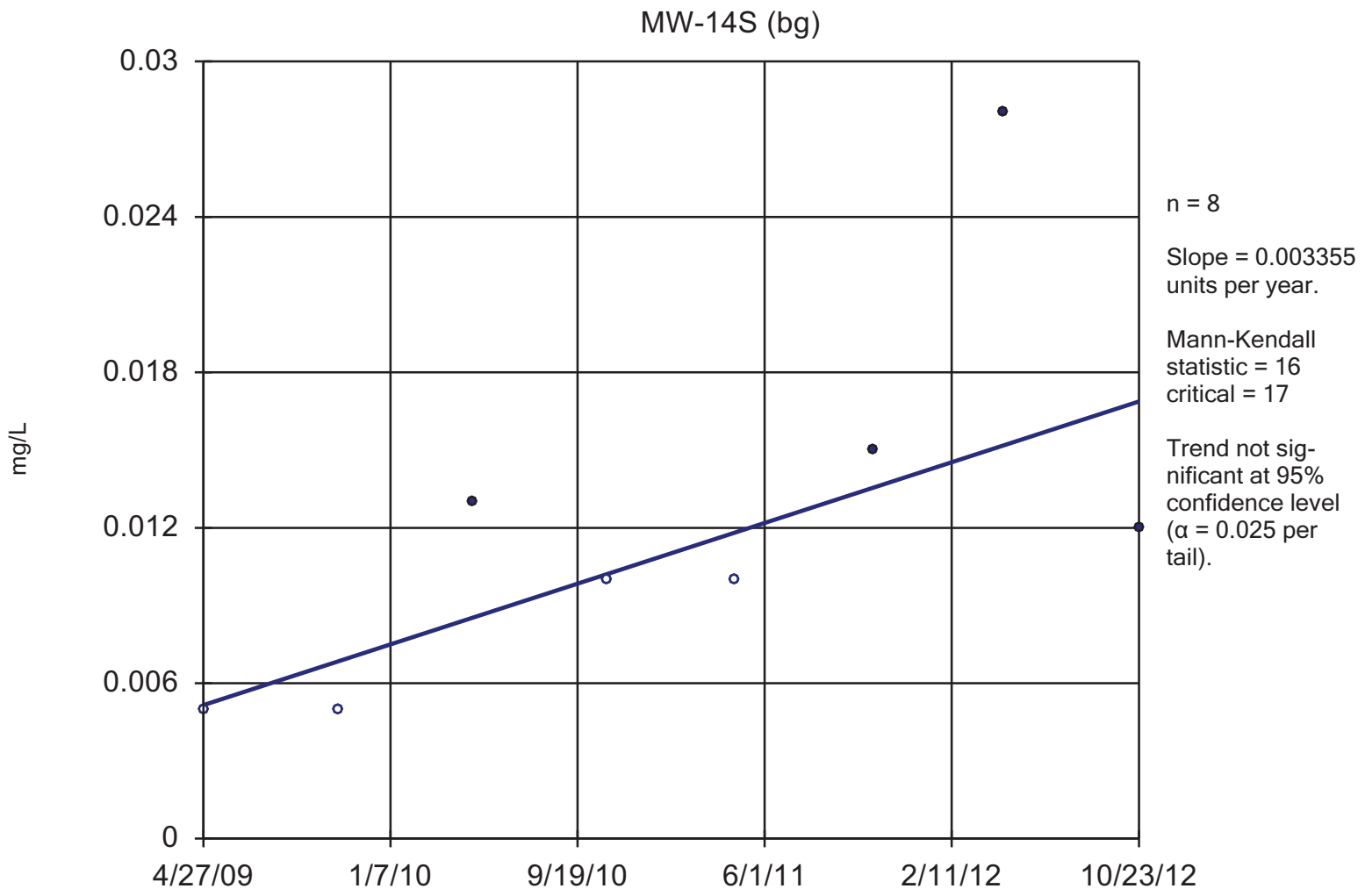

Constituent: Molybdenum, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

# Sen's Slope Estimator



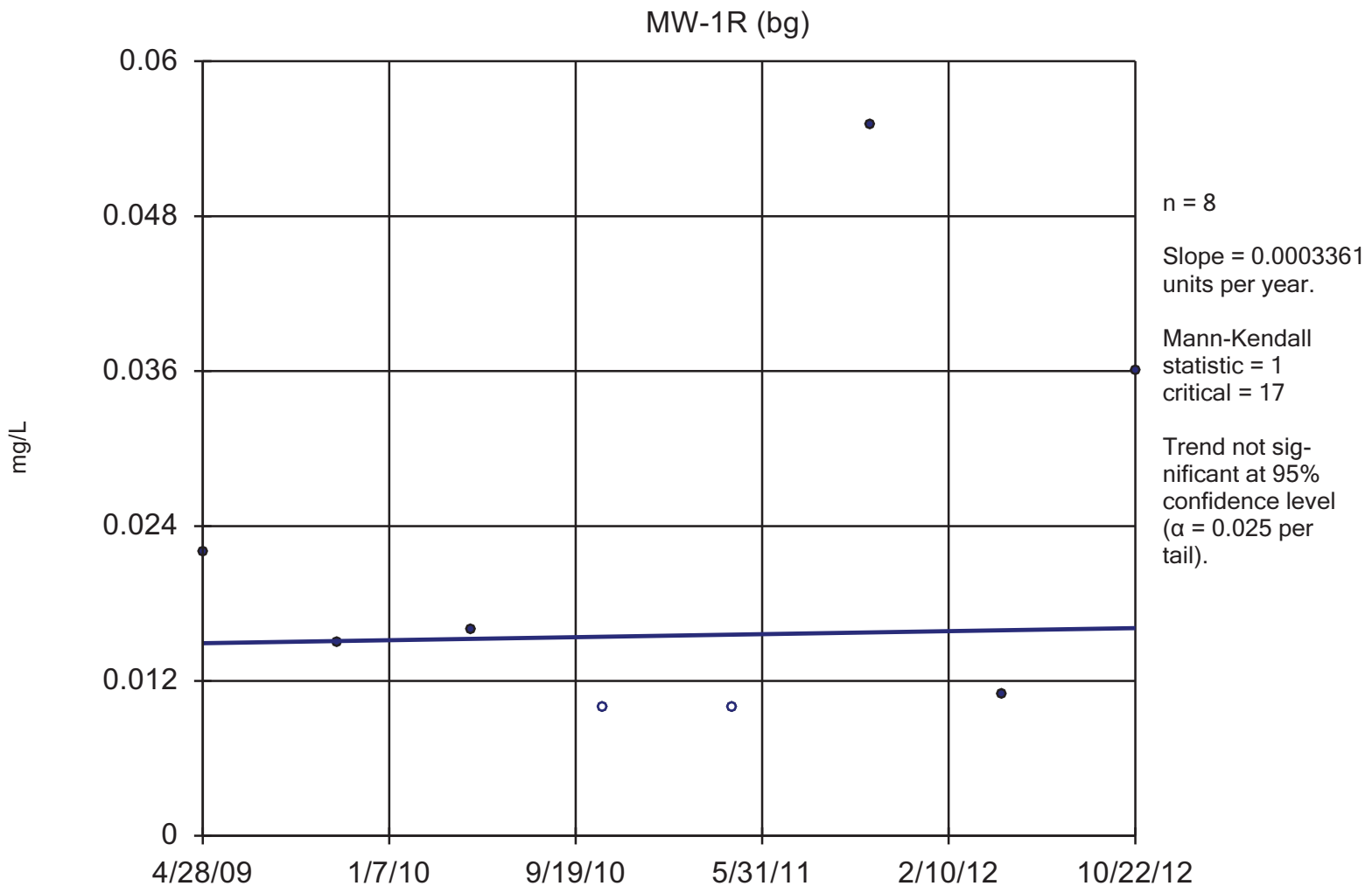

Constituent: Molybdenum, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

v.9.2.17 For the statistical analyses of ground water by Weaver Boos Consultants only. UG

Hollow symbols indicate censored values.

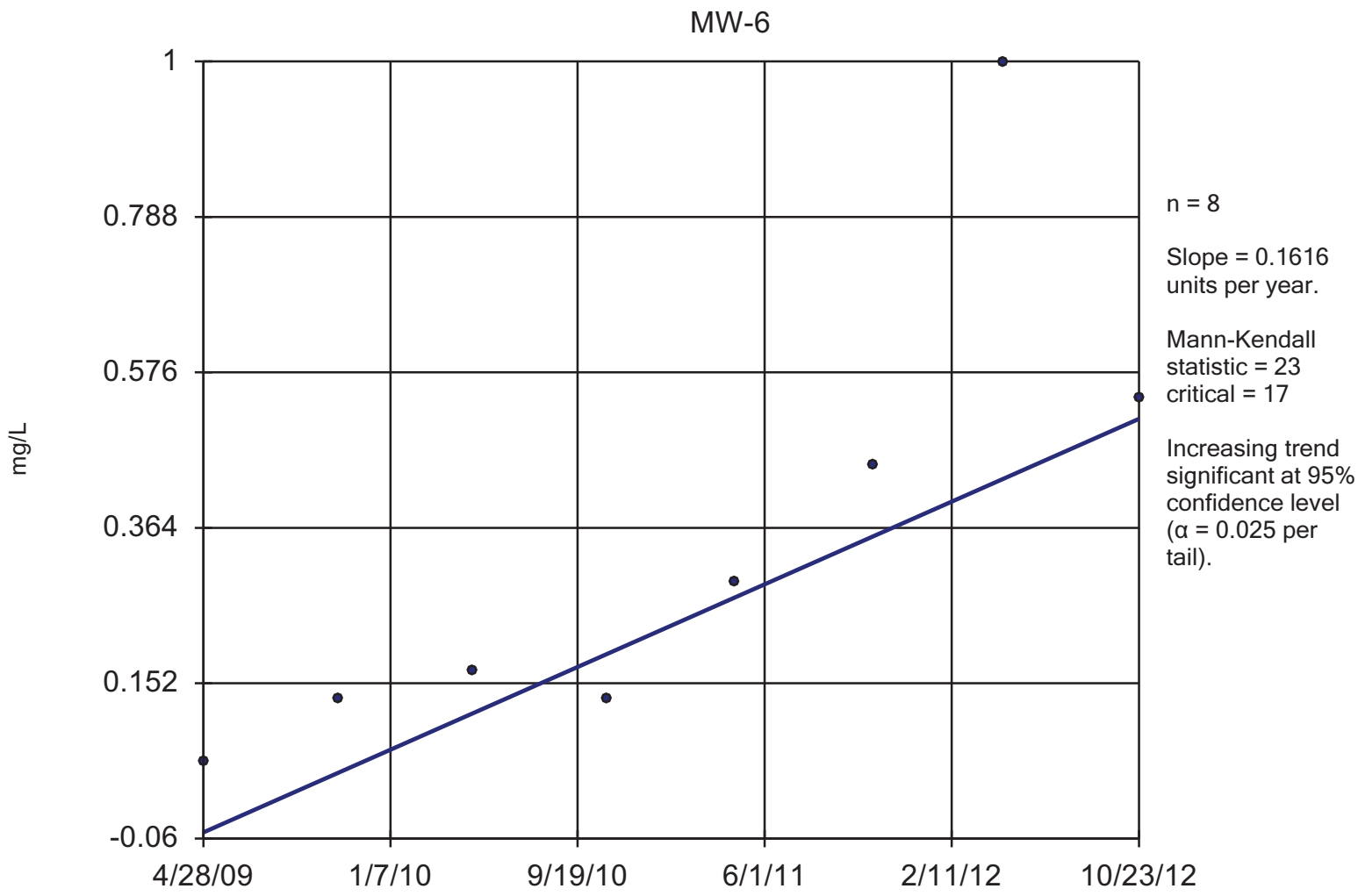
# Sen's Slope Estimator




Constituent: Molybdenum, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

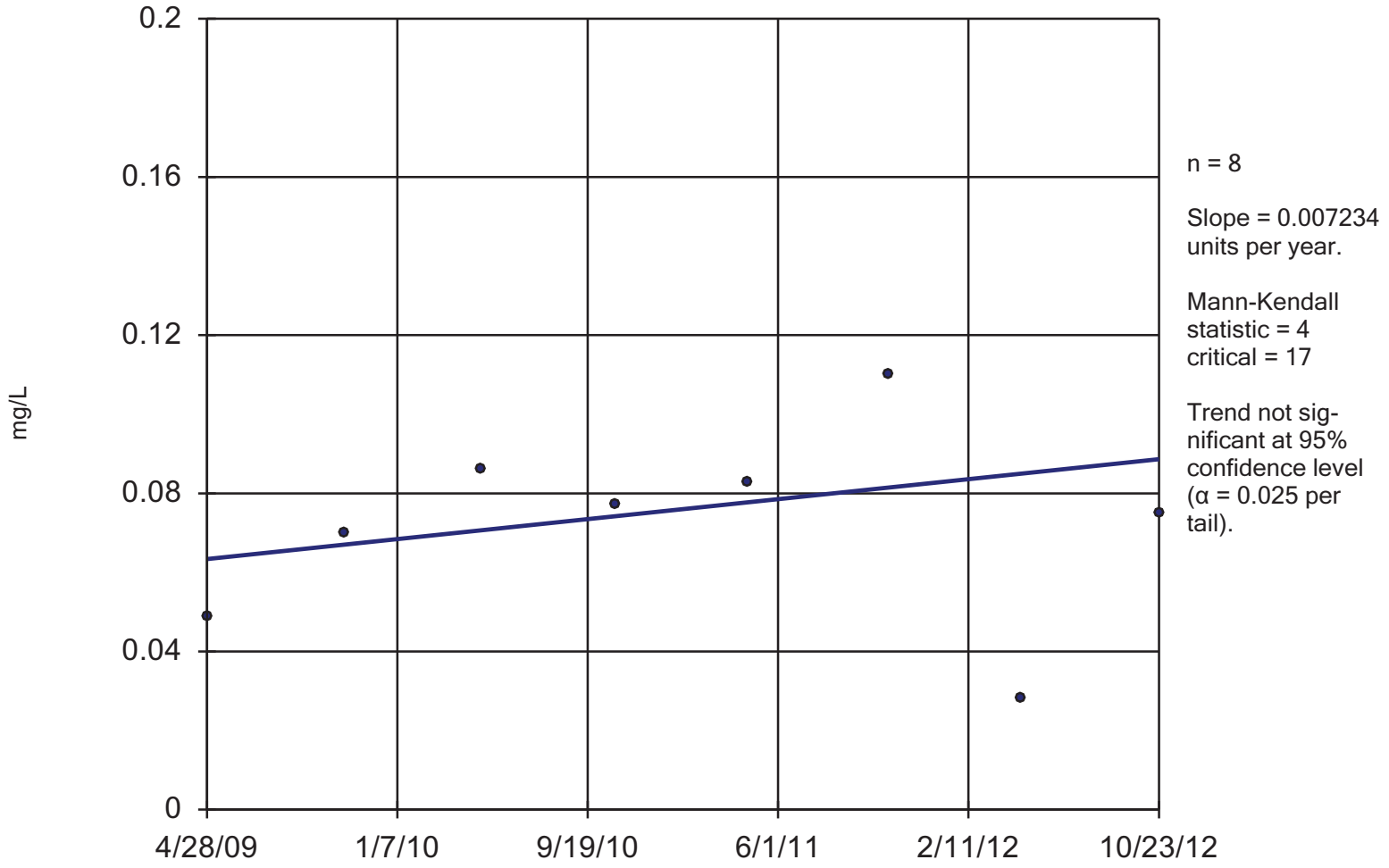



Constituent: Molybdenum, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-7

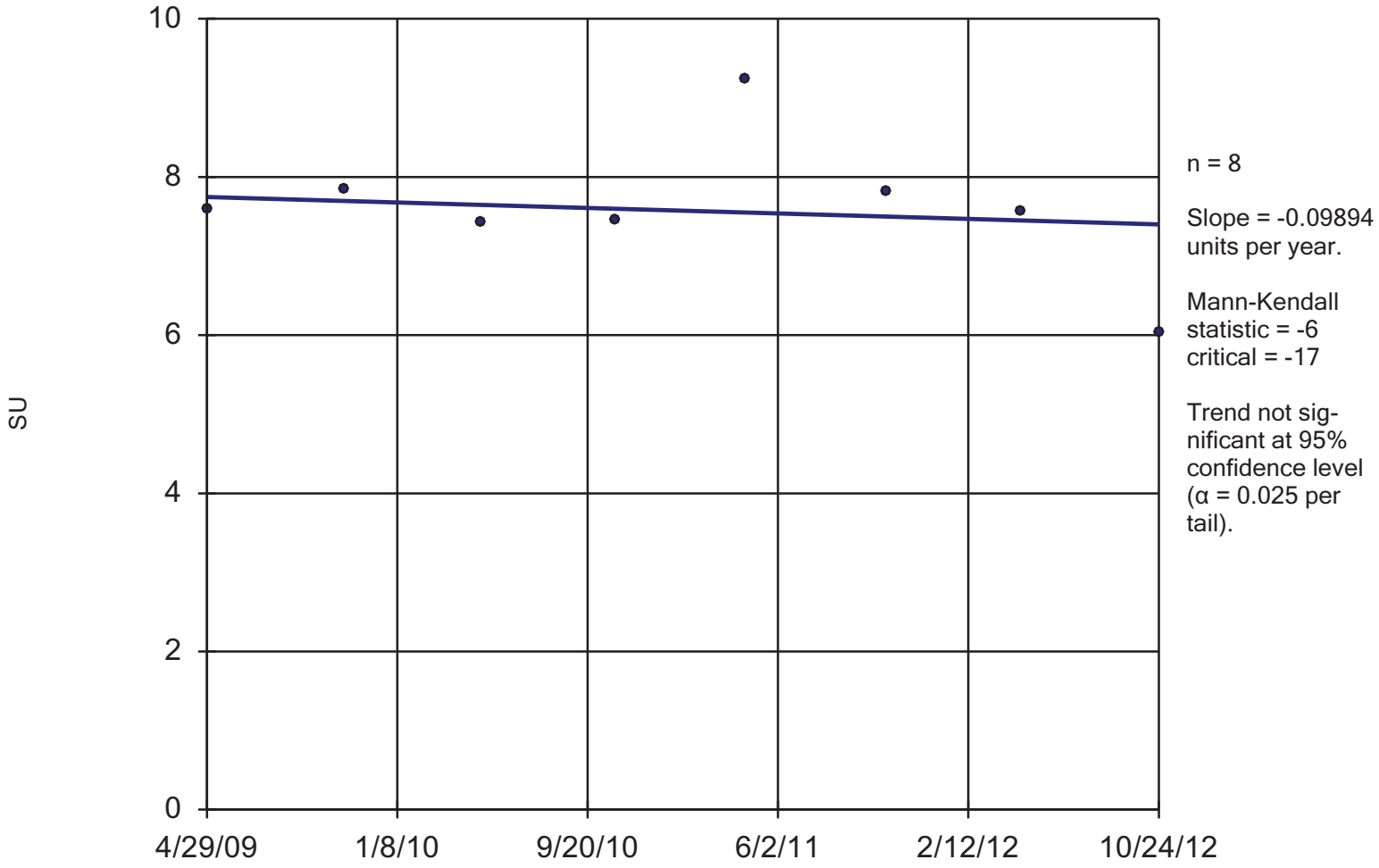



Constituent: Molybdenum, dissolved  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-10

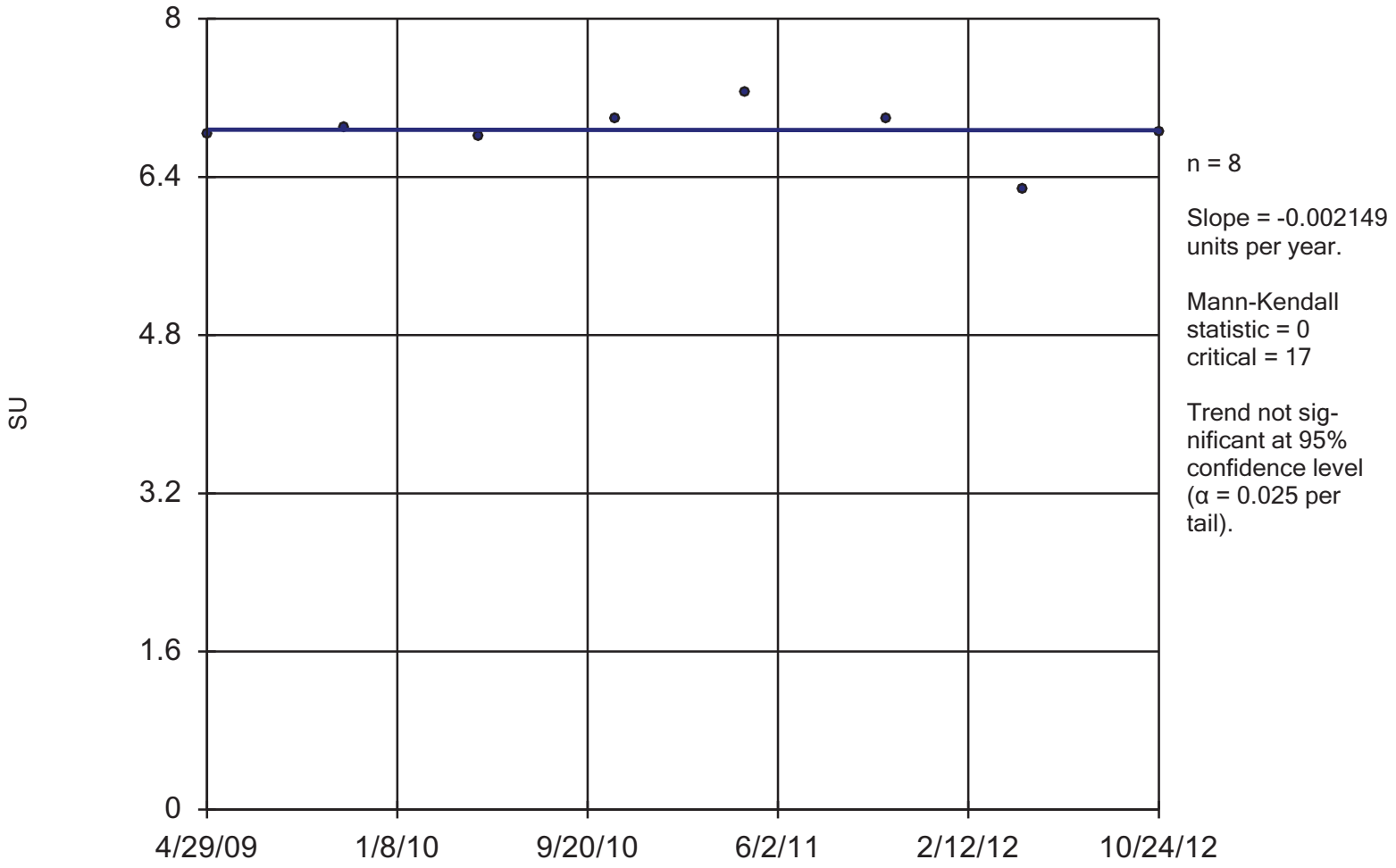



Constituent: pH, Field  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-11

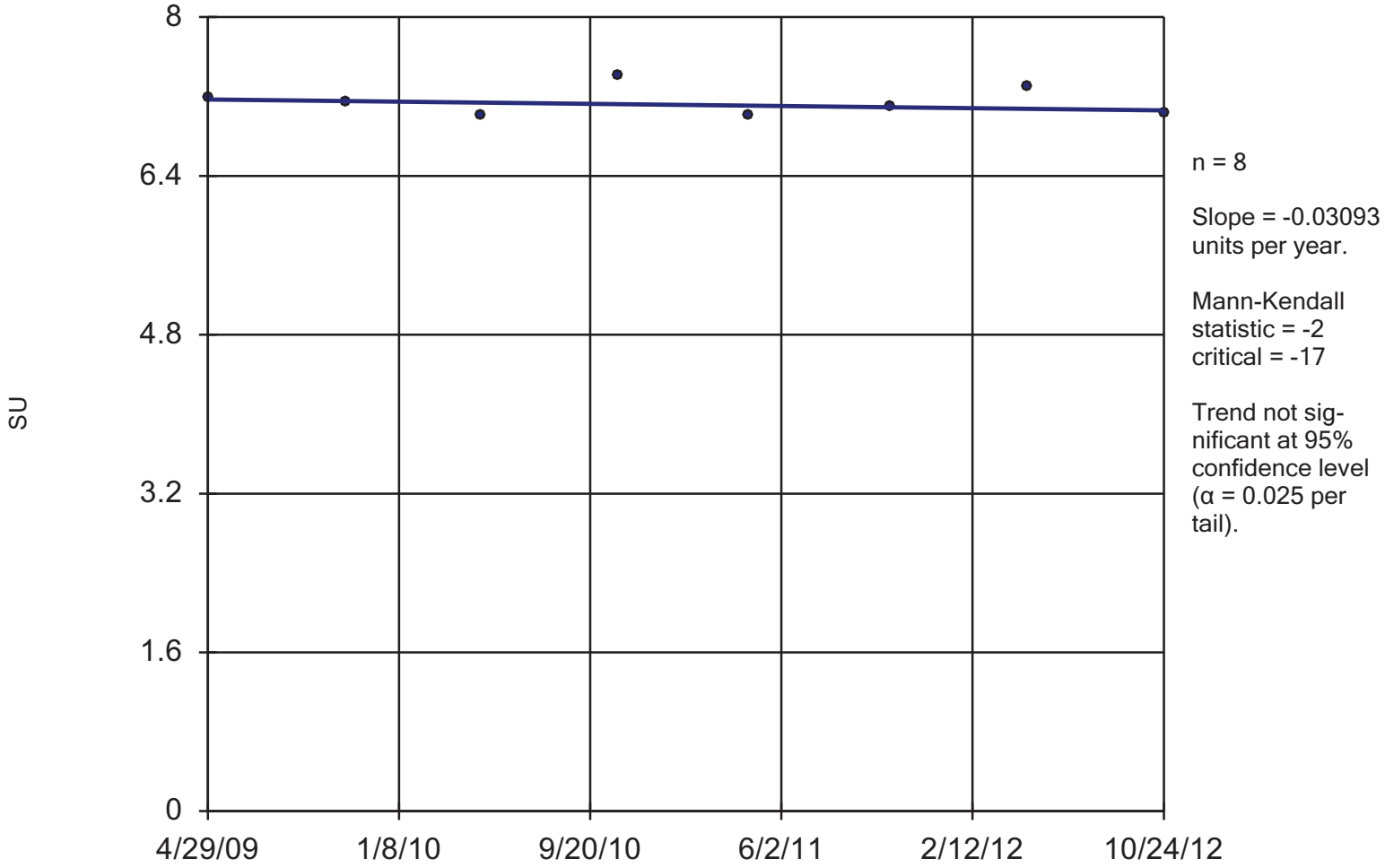



Constituent: pH, Field  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-8

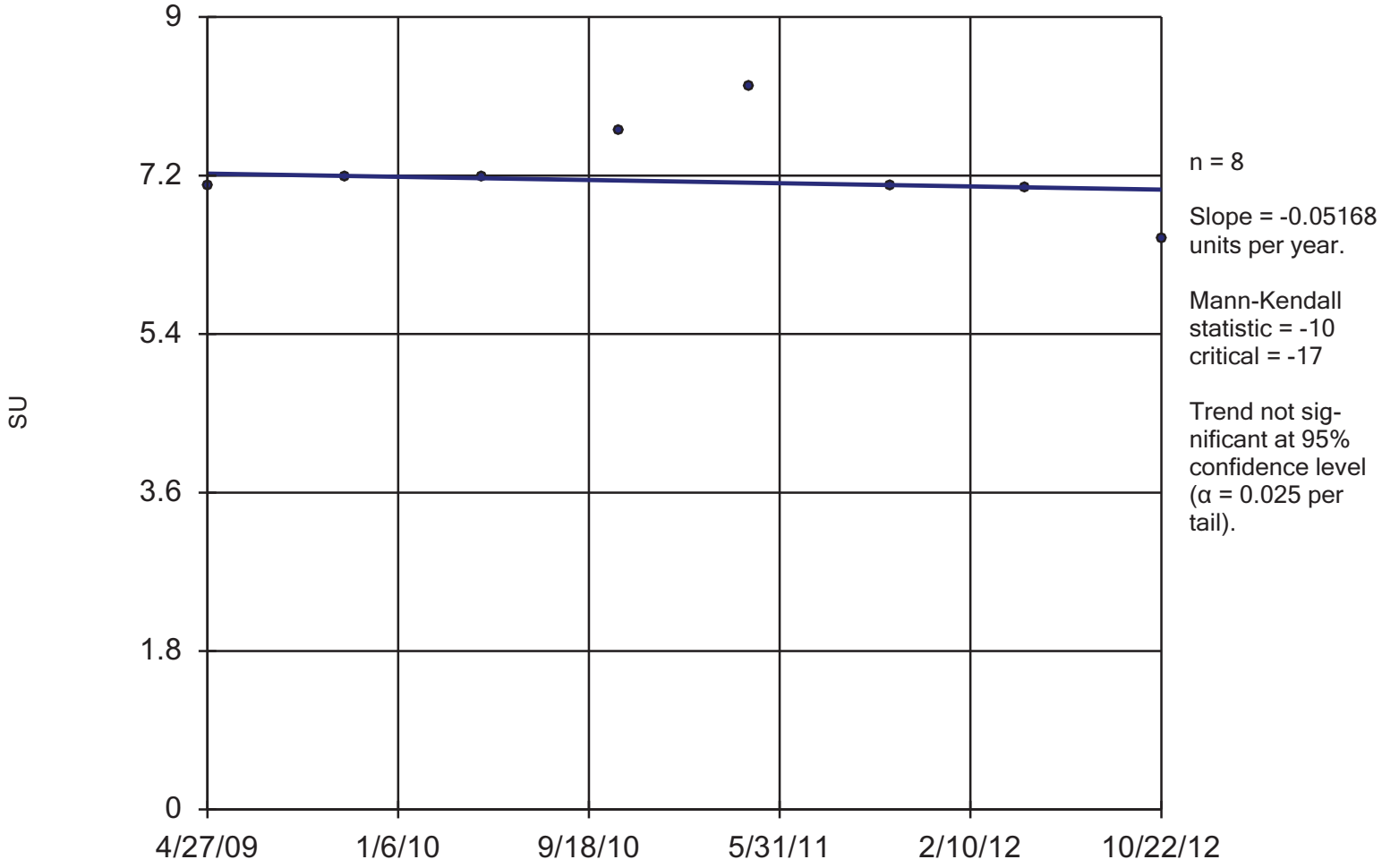



Constituent: pH, Field  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-13D (bg)

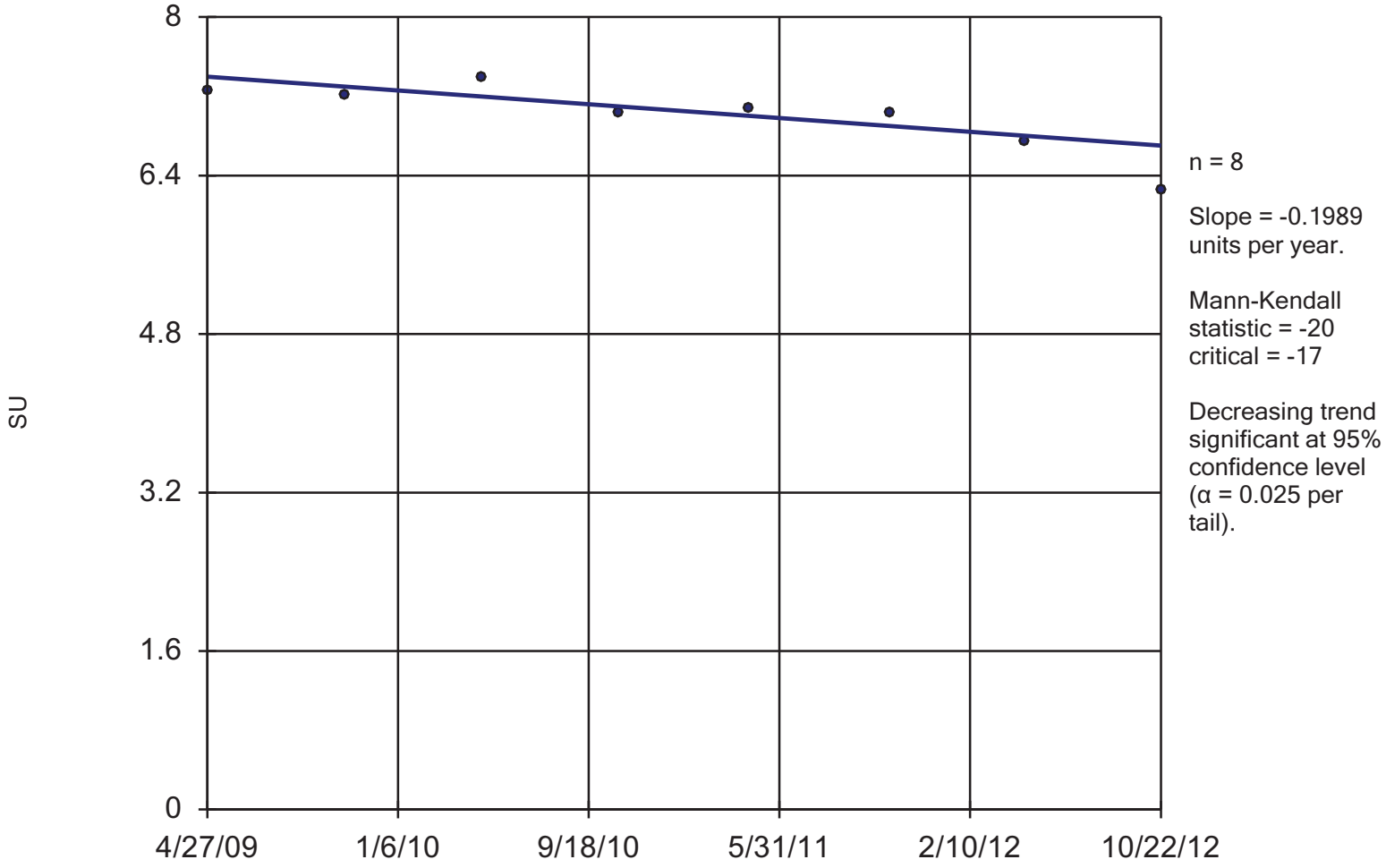



Constituent: pH, Field  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-13S (bg)

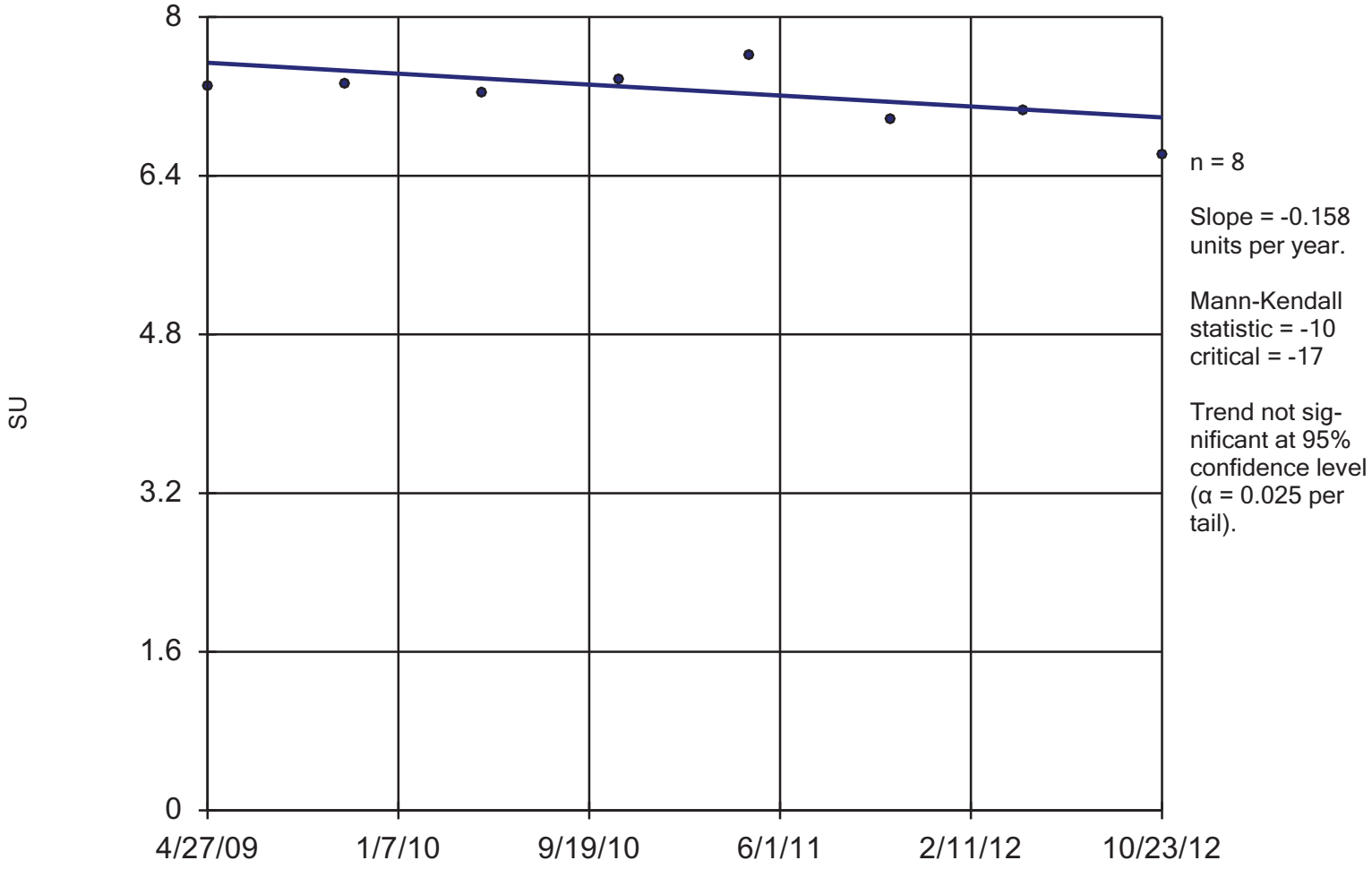



Constituent: pH, Field  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-14D (bg)

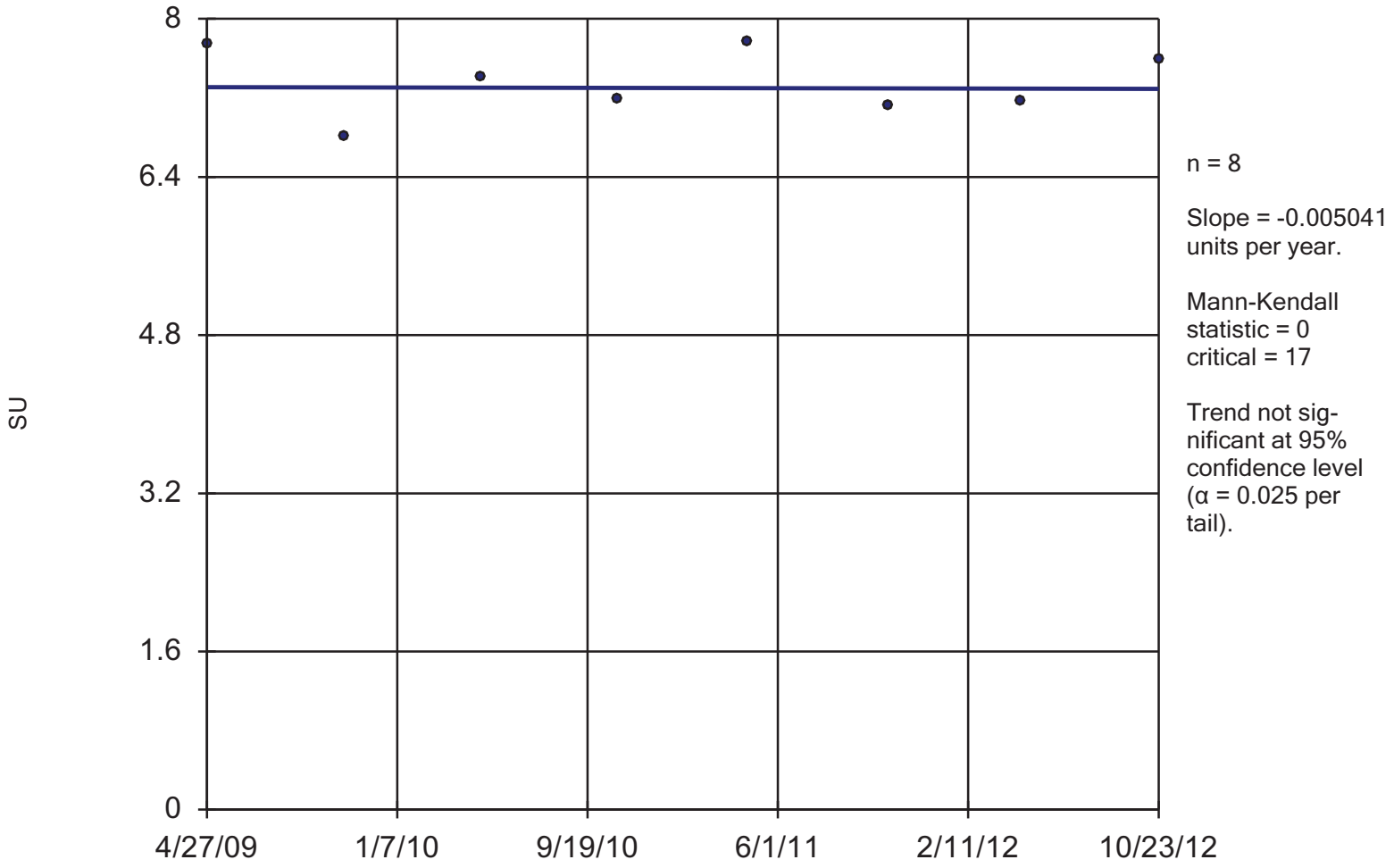



Constituent: pH, Field  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-14S (bg)

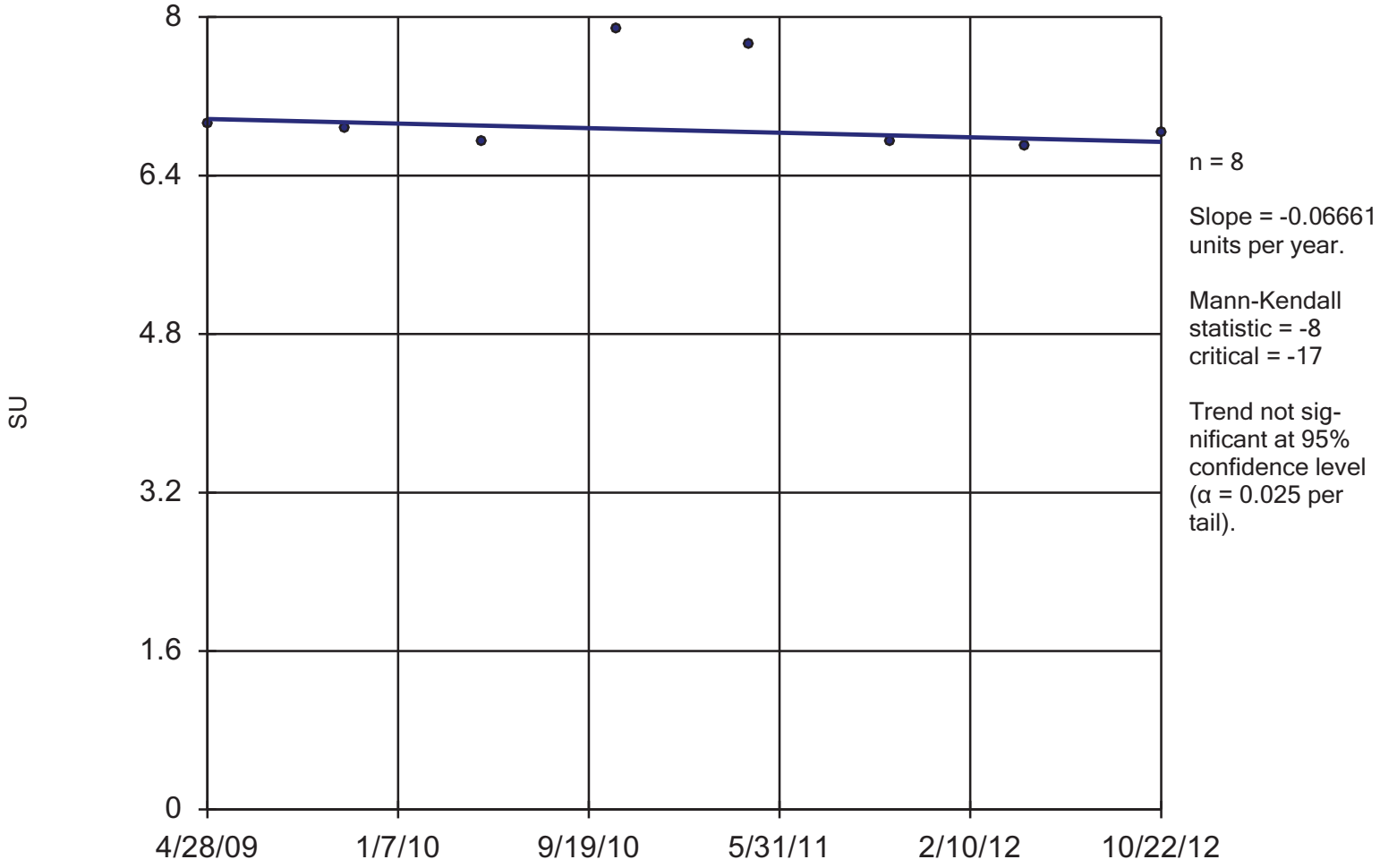



Constituent: pH, Field  Analysis Run 12/14/2012 9:26 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-1R (bg)

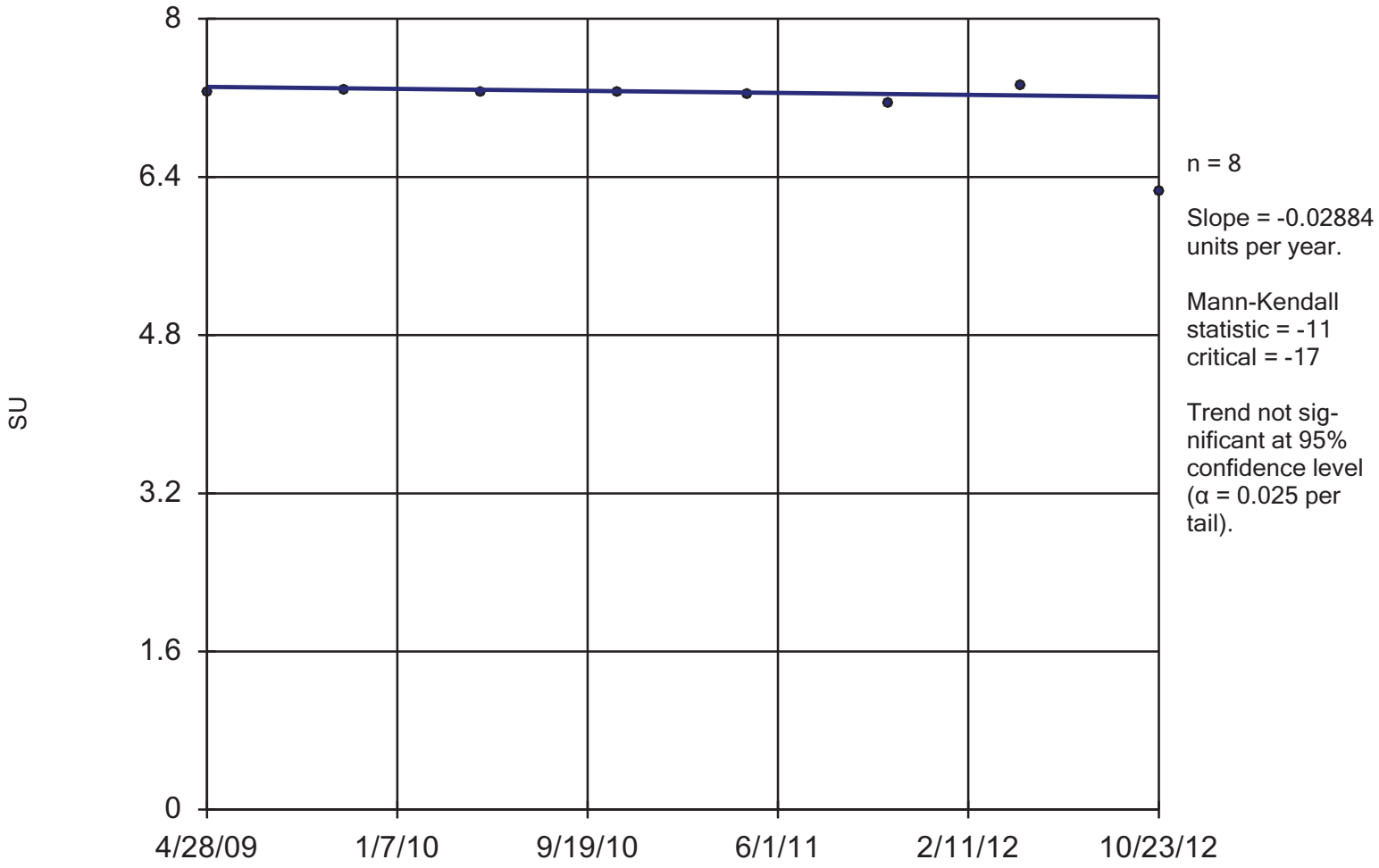



Constituent: pH, Field  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-6

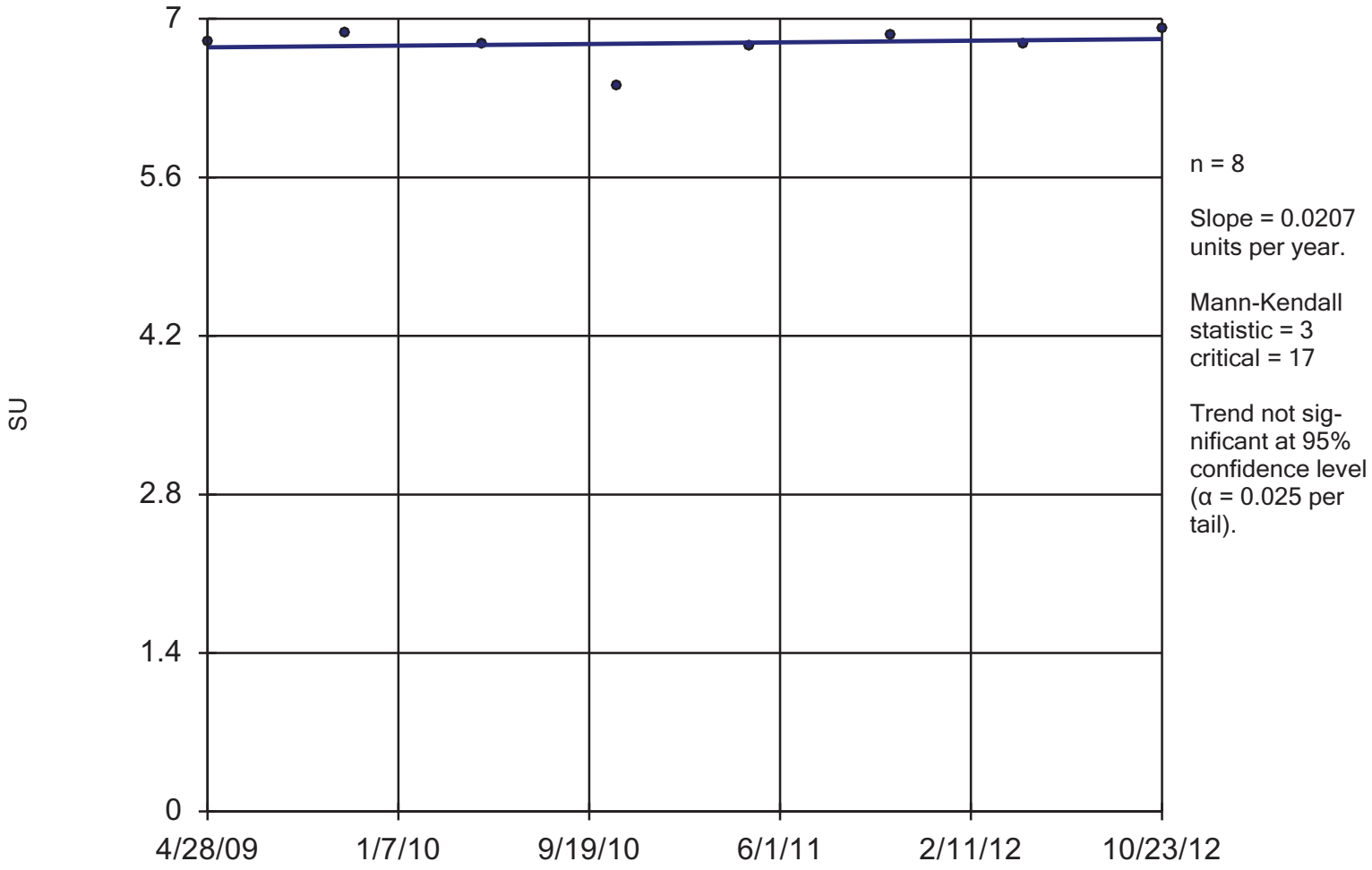



Constituent: pH, Field  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-7

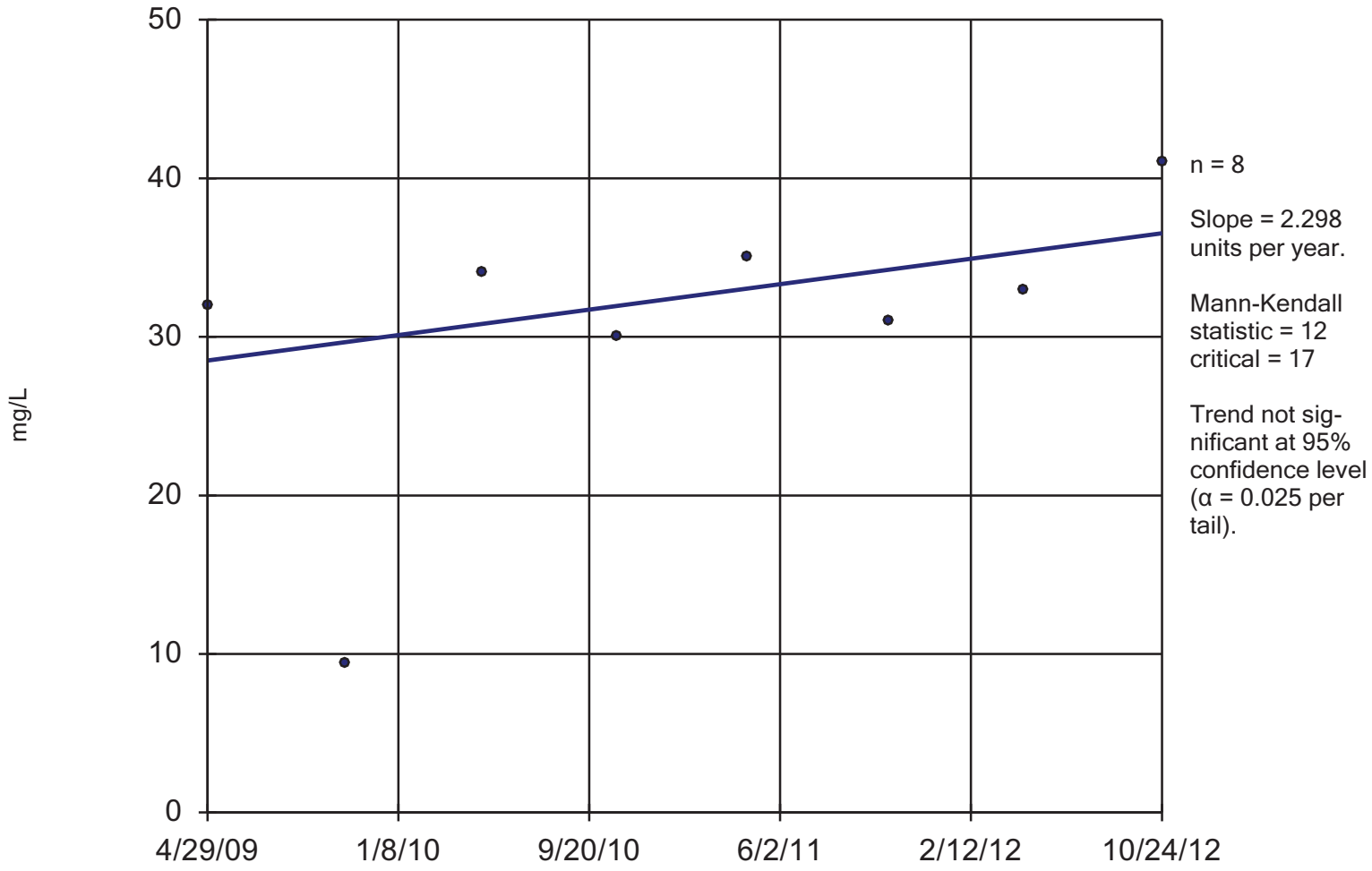



Constituent: pH, Field  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-10

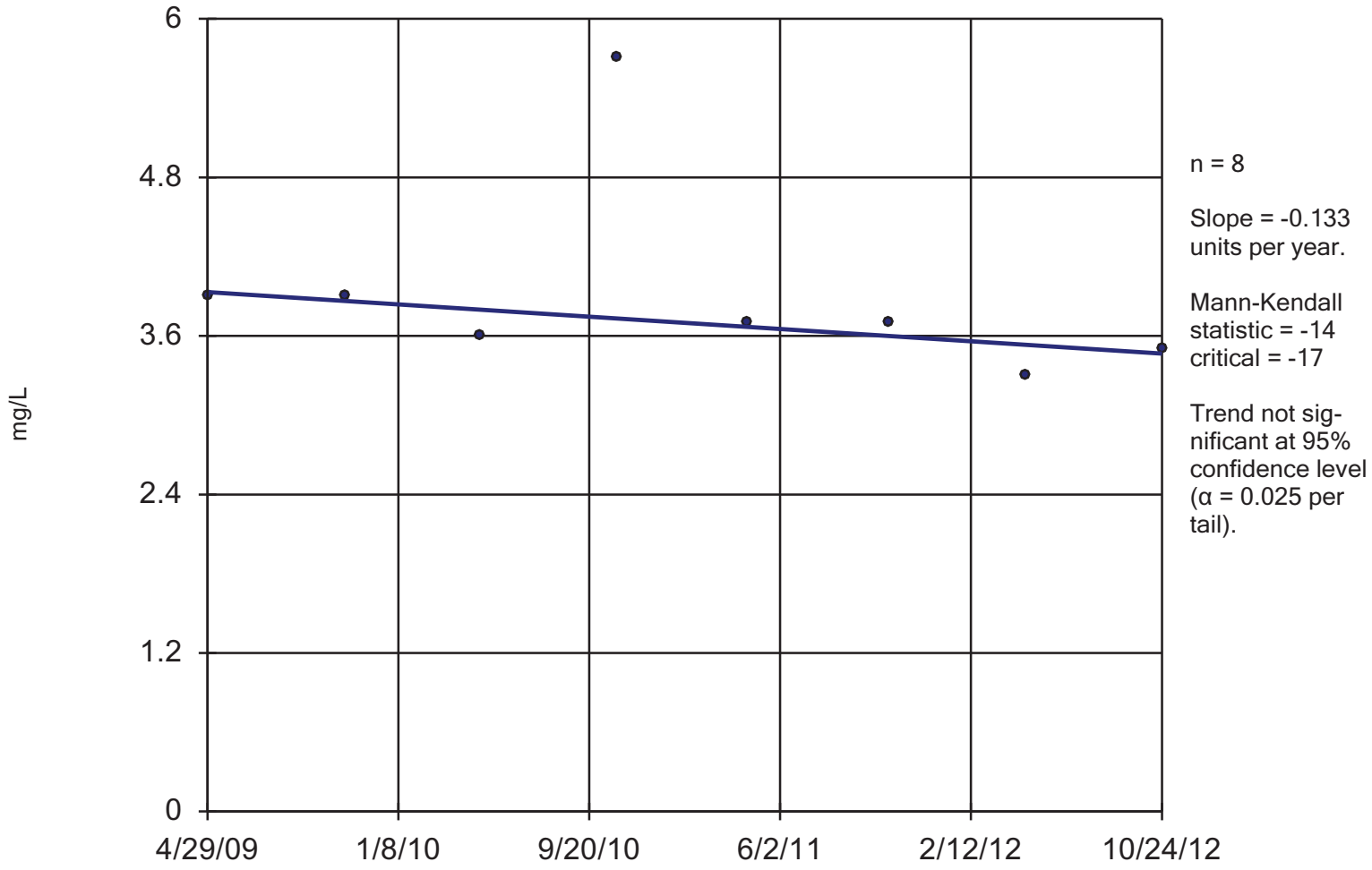



Constituent: Potassium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-11

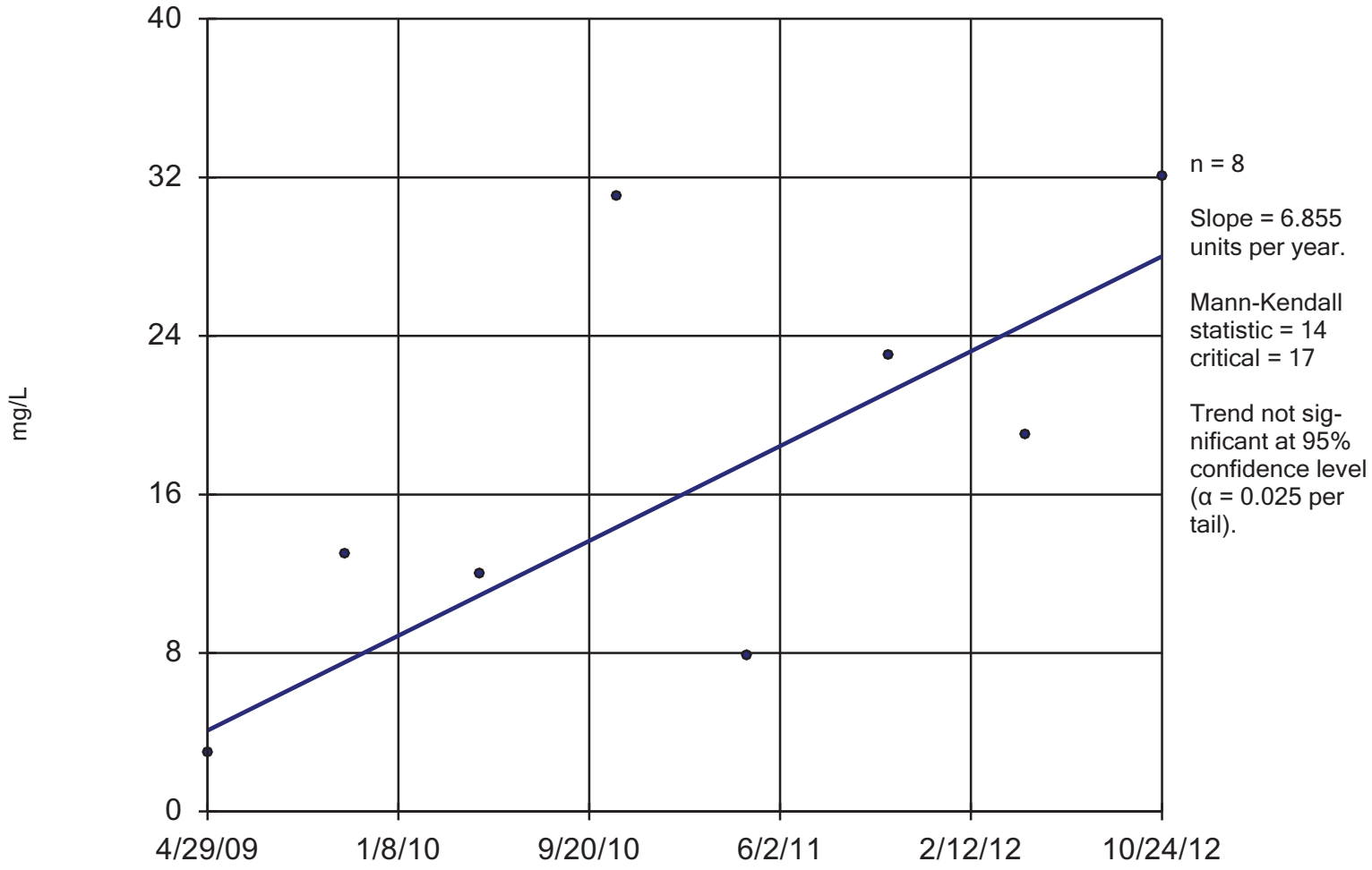



Constituent: Potassium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

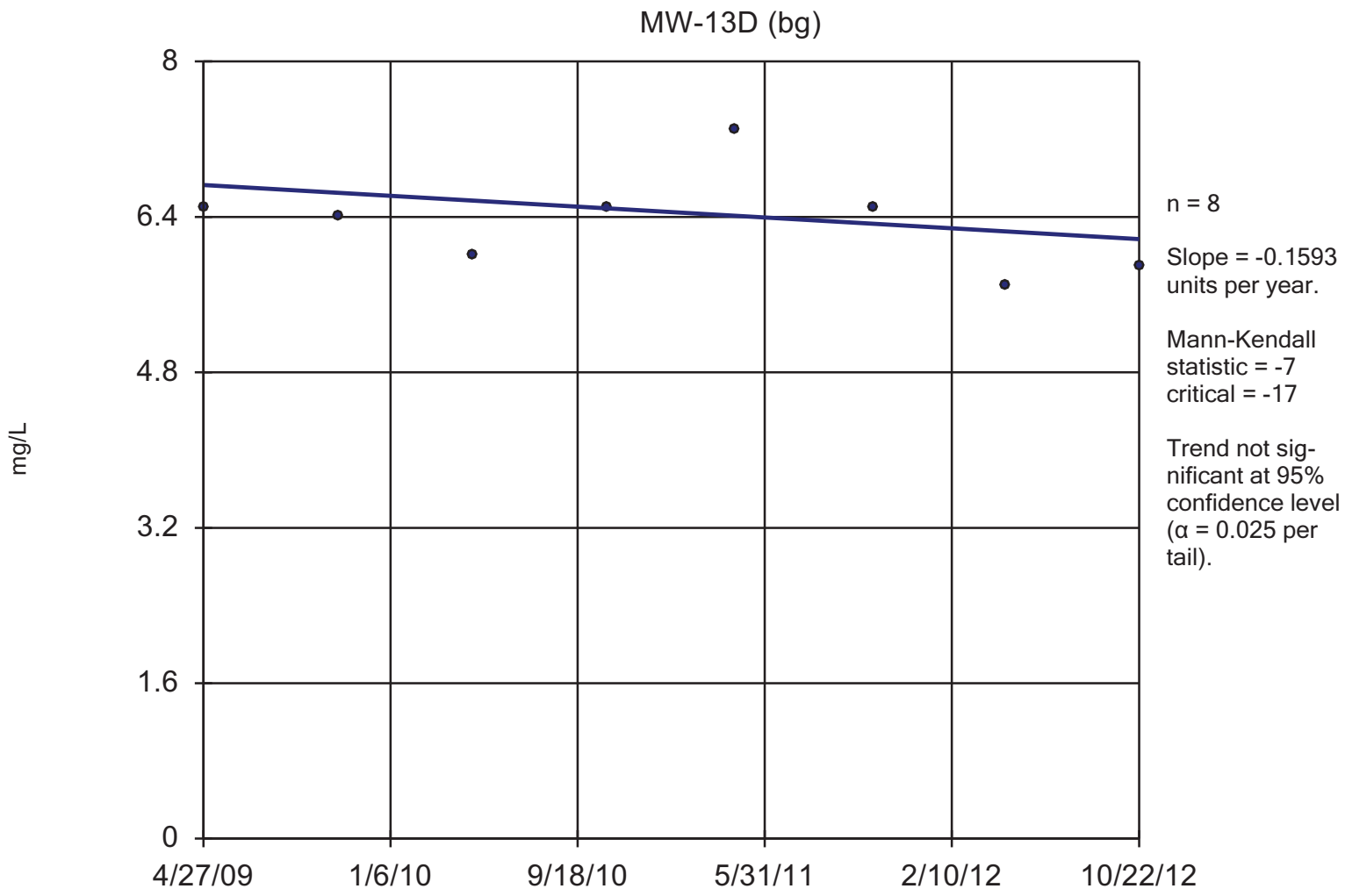
## MW-8




Constituent: Potassium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

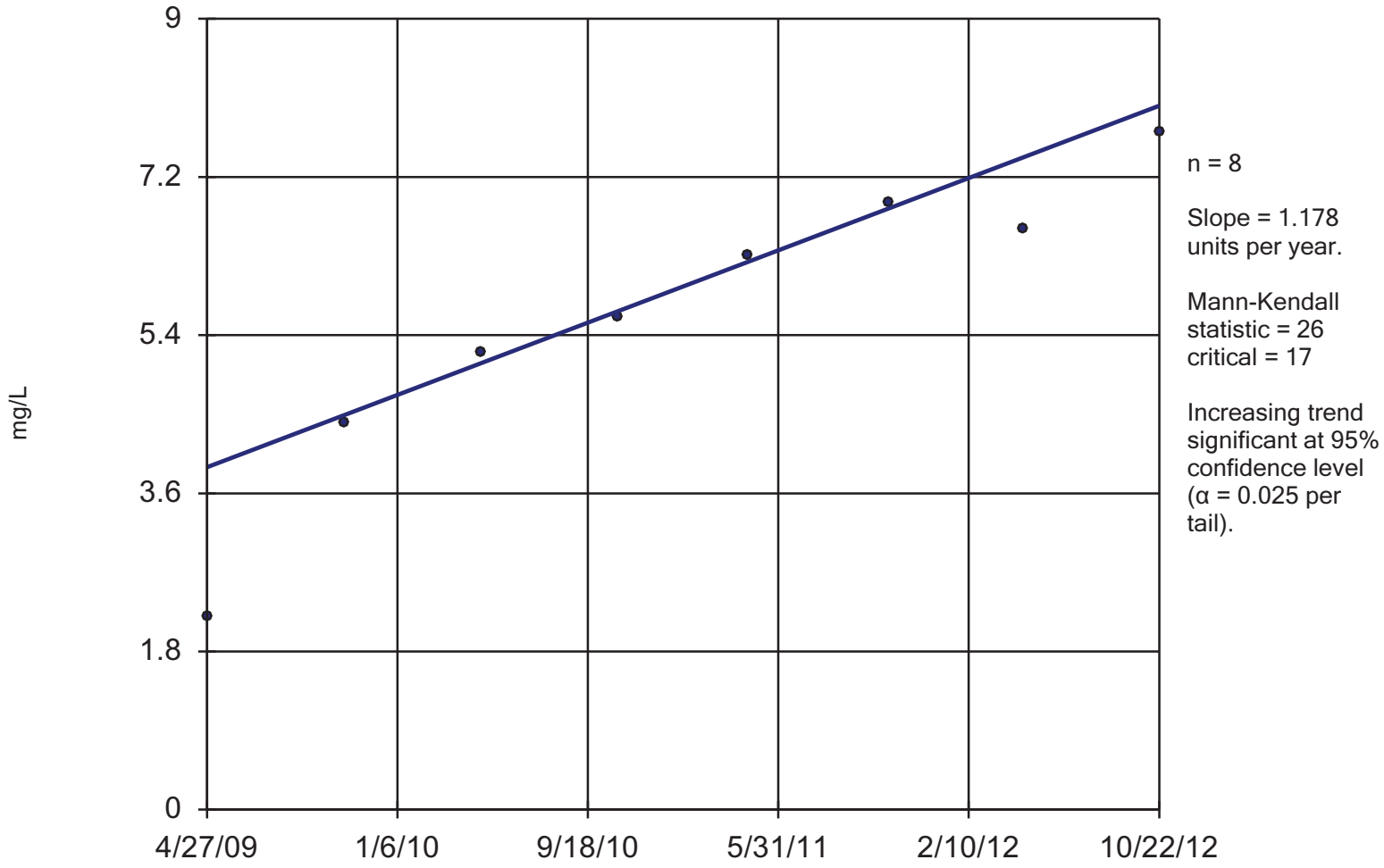



Constituent: Potassium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

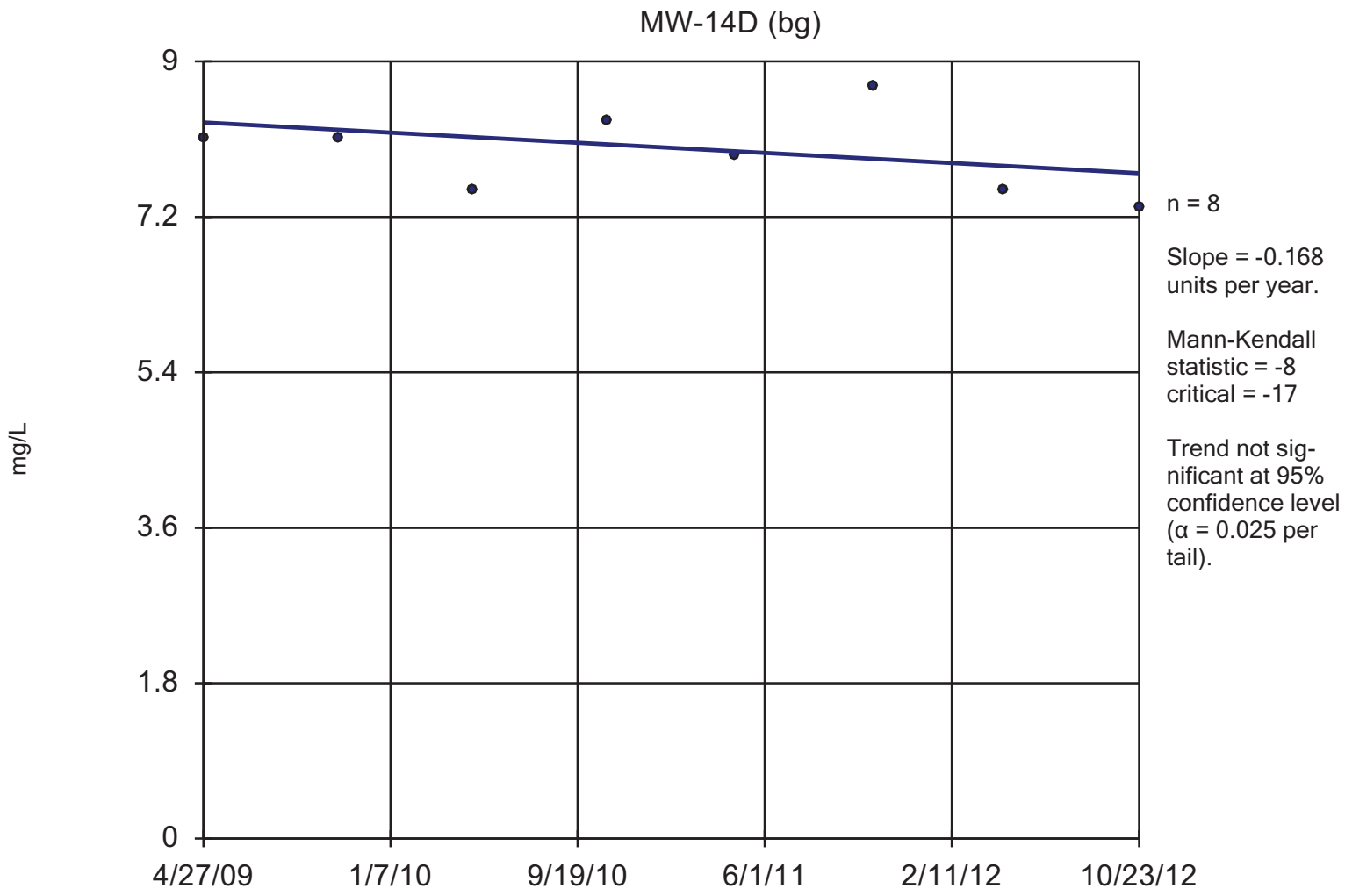
## MW-13S (bg)




Constituent: Potassium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

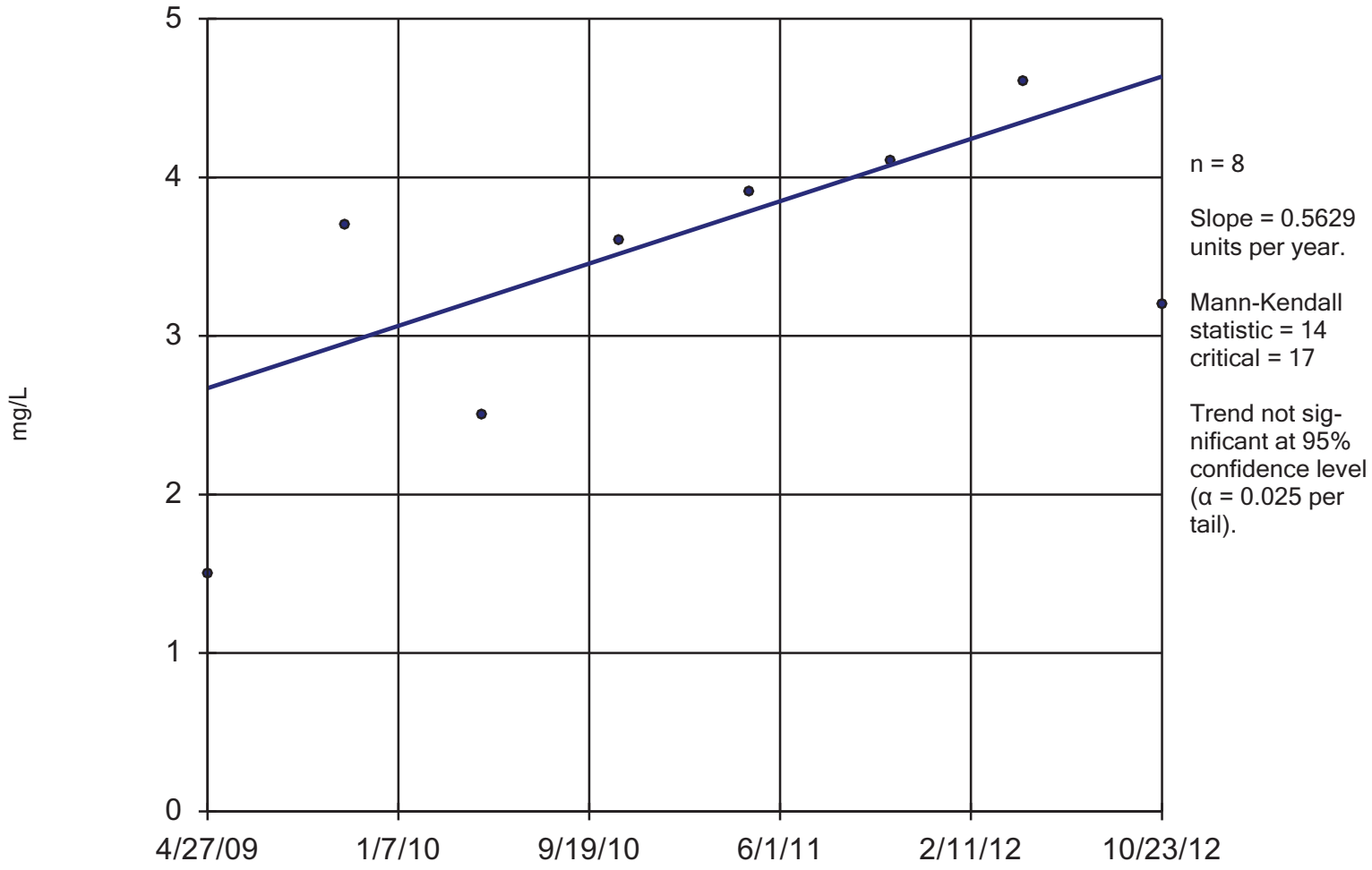



Constituent: Potassium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

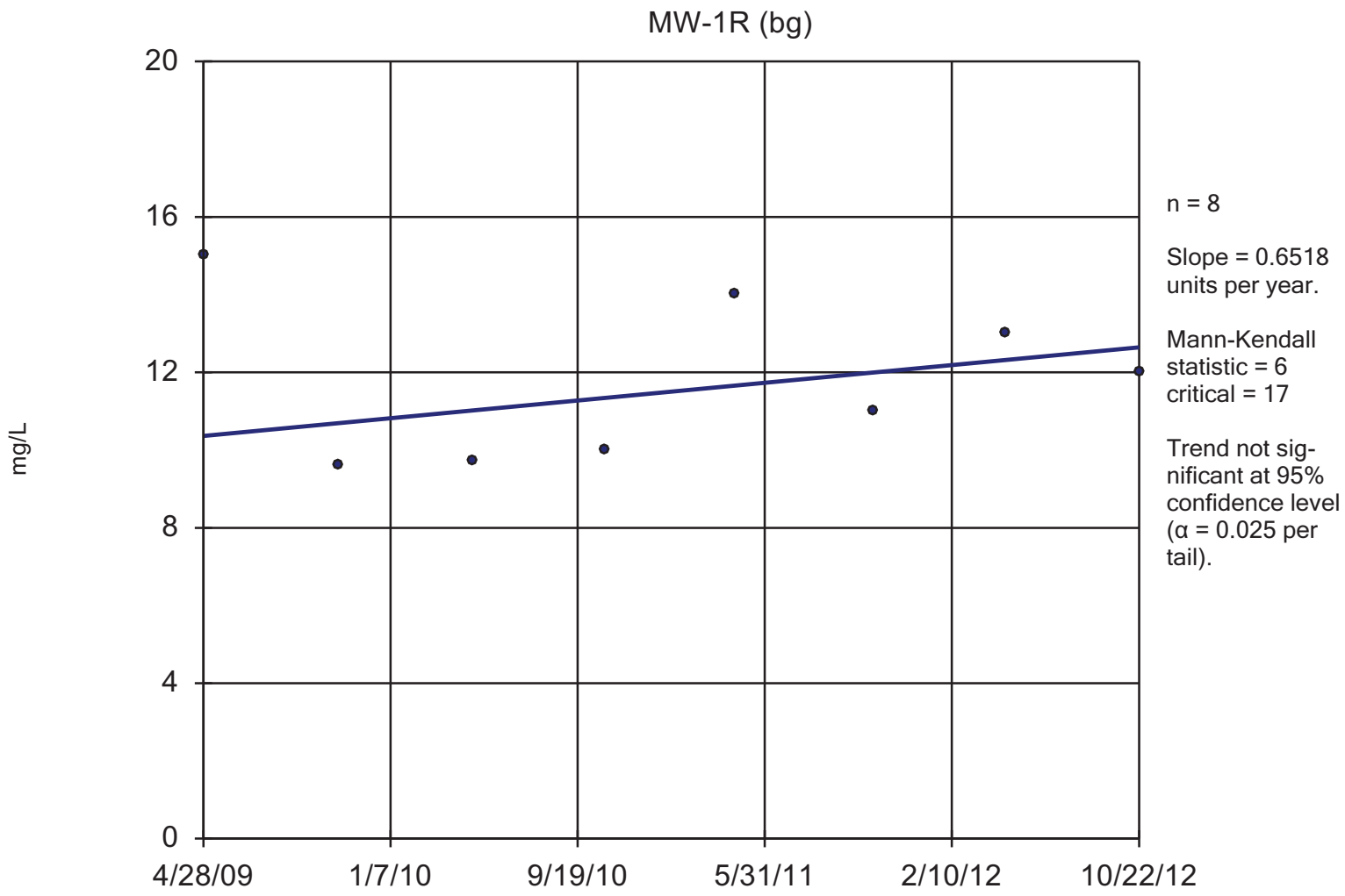
## MW-14S (bg)




Constituent: Potassium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

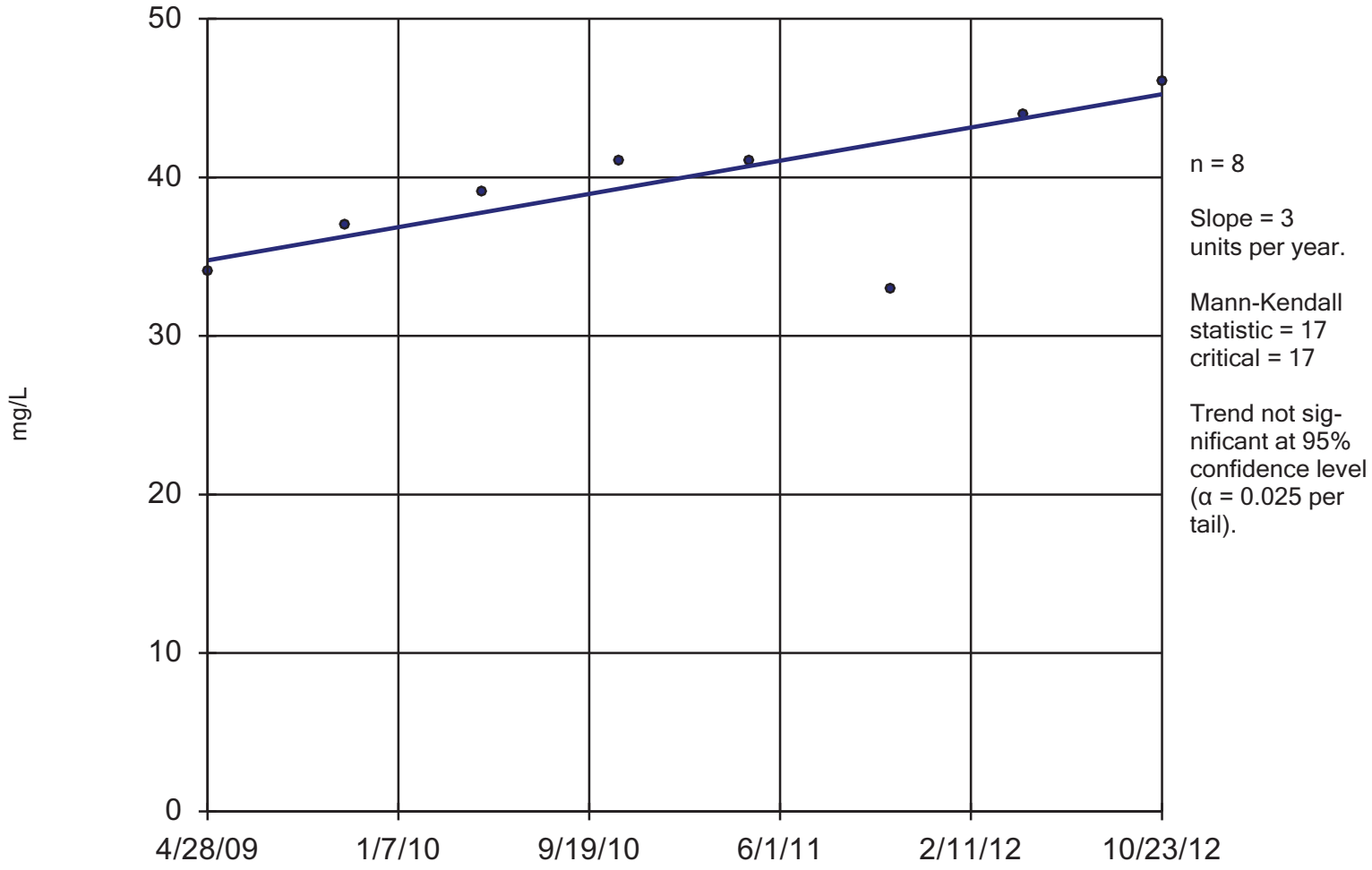



Constituent: Potassium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-6

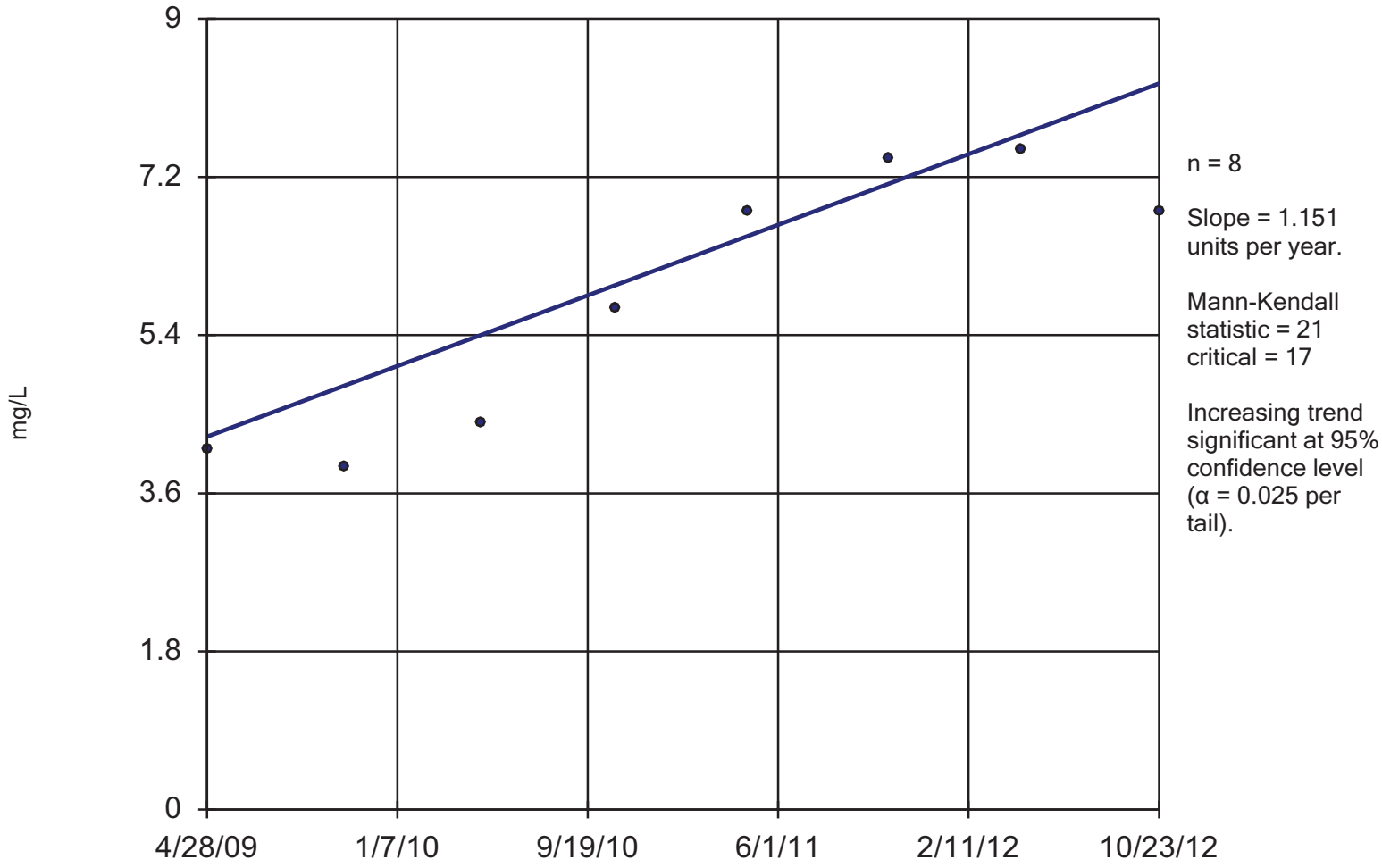



Constituent: Potassium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-7

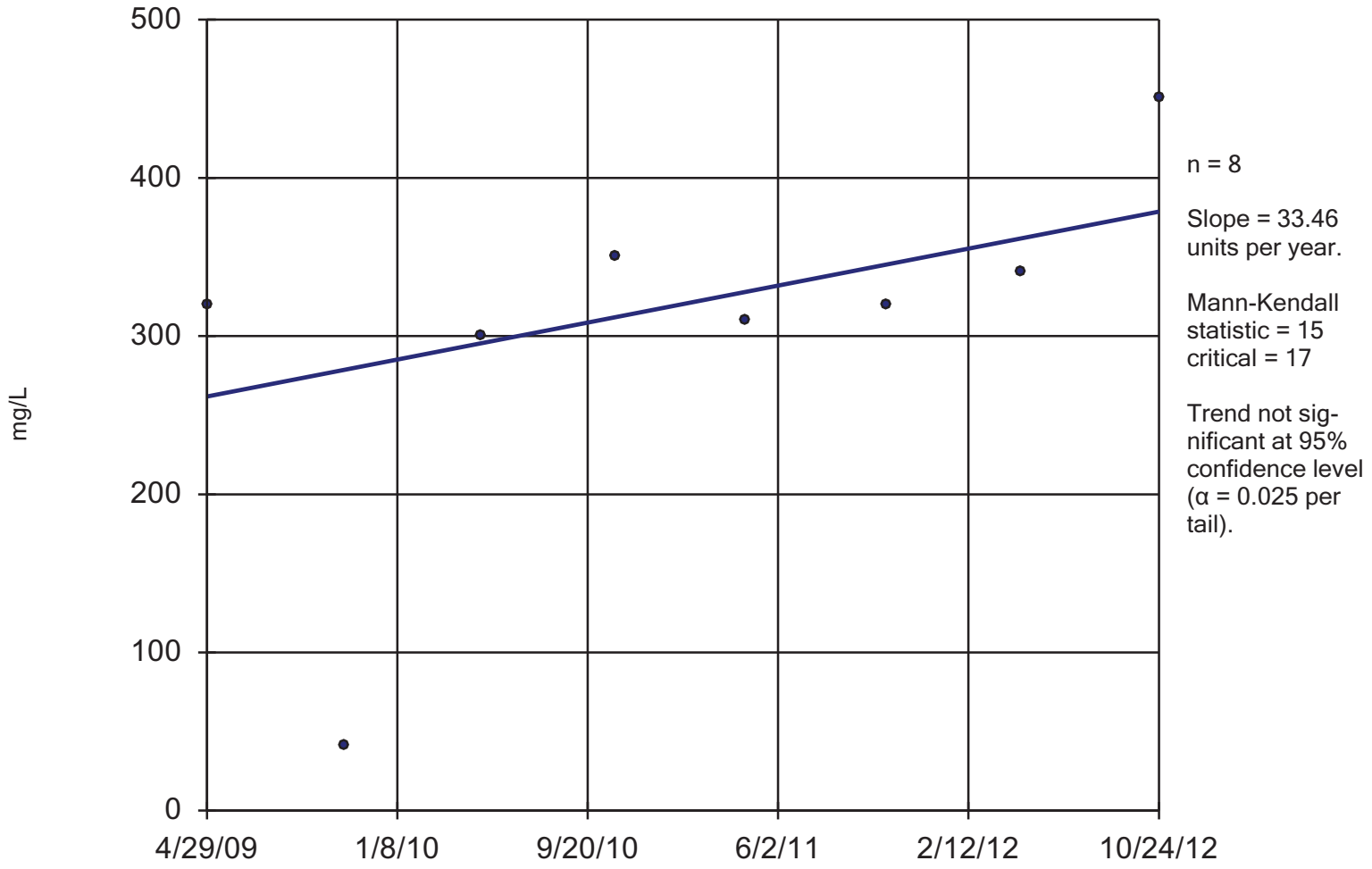



Constituent: Potassium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

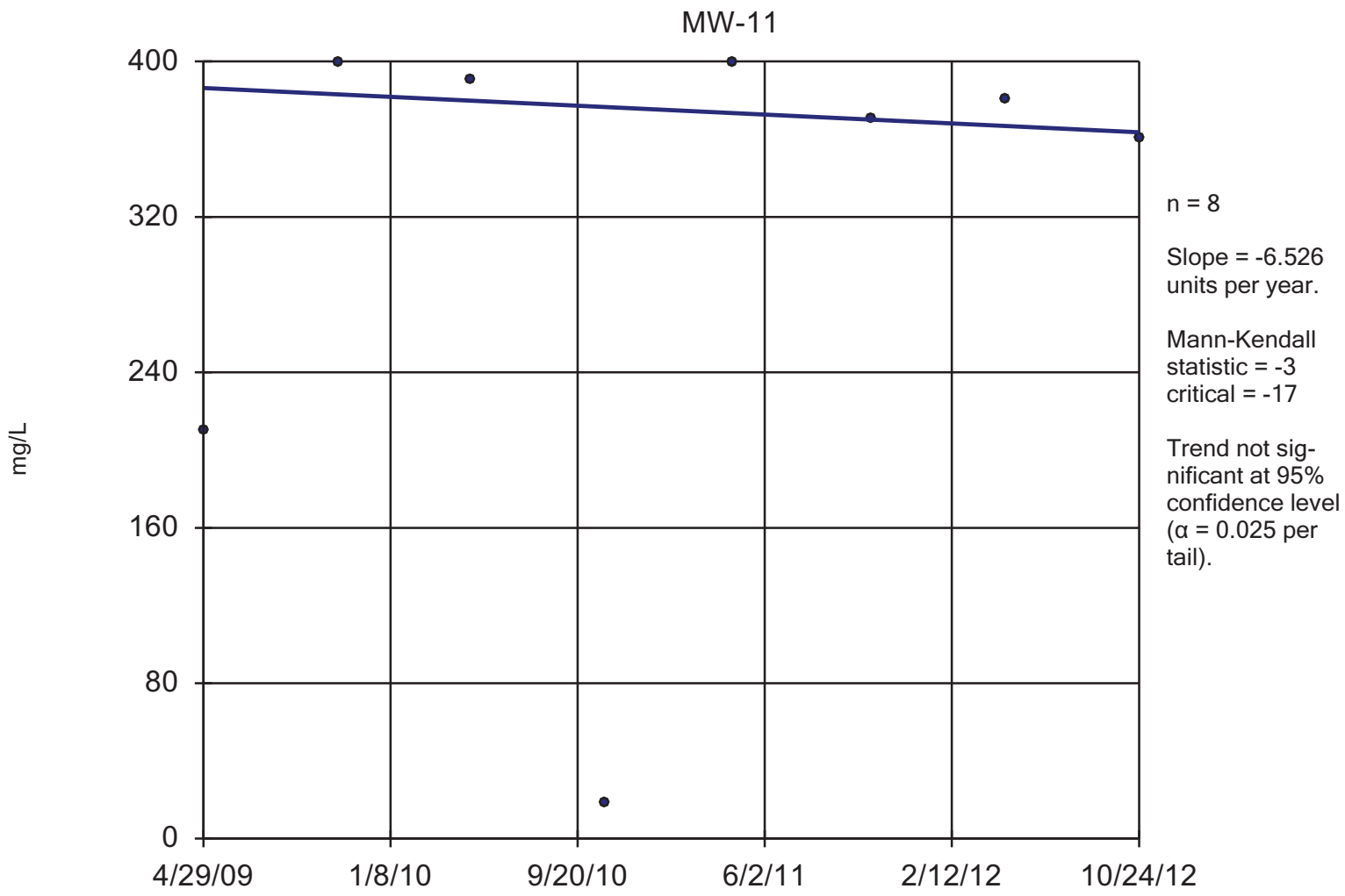
## MW-10




Constituent: Sodium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

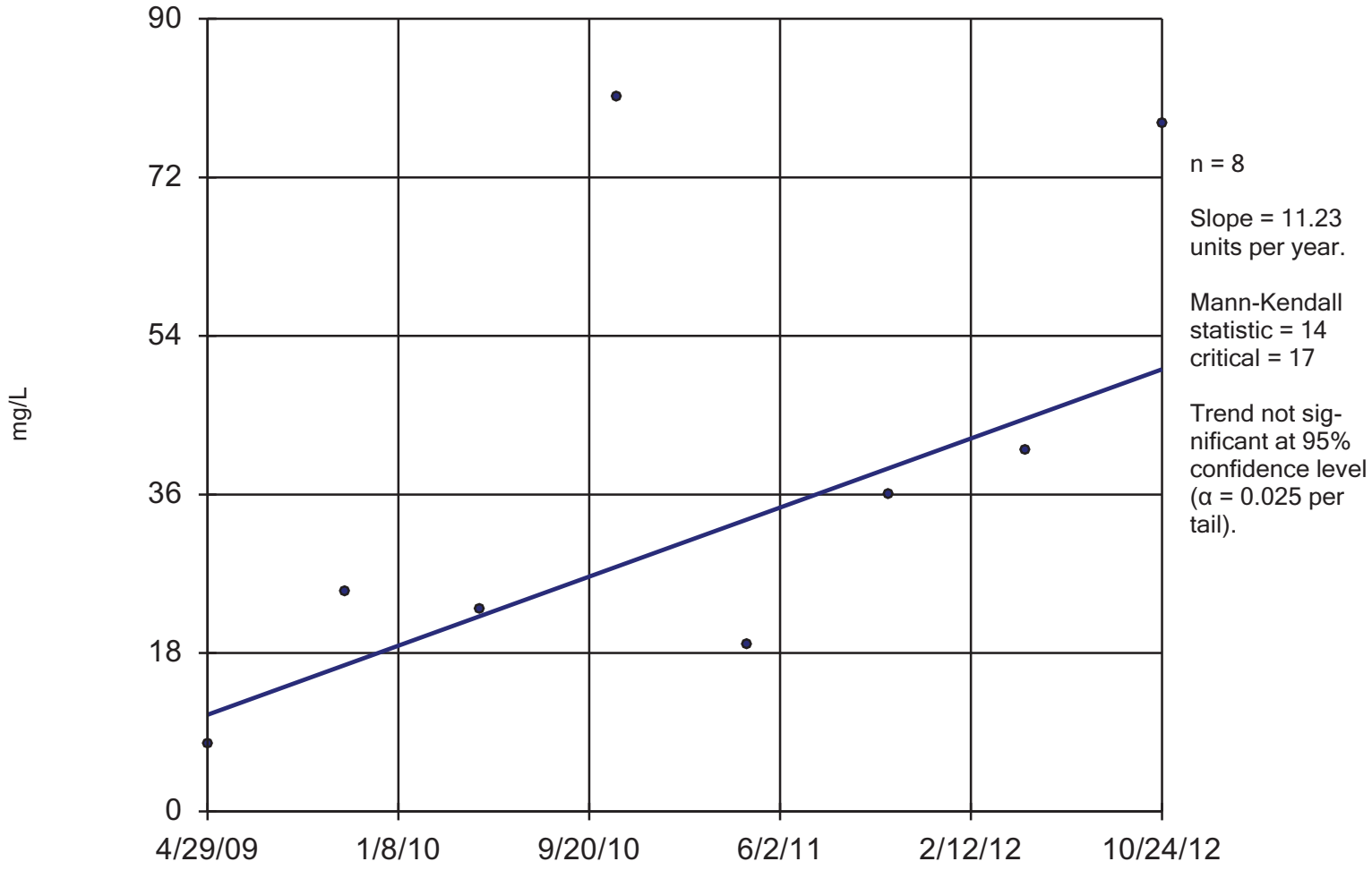



Constituent: Sodium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-8

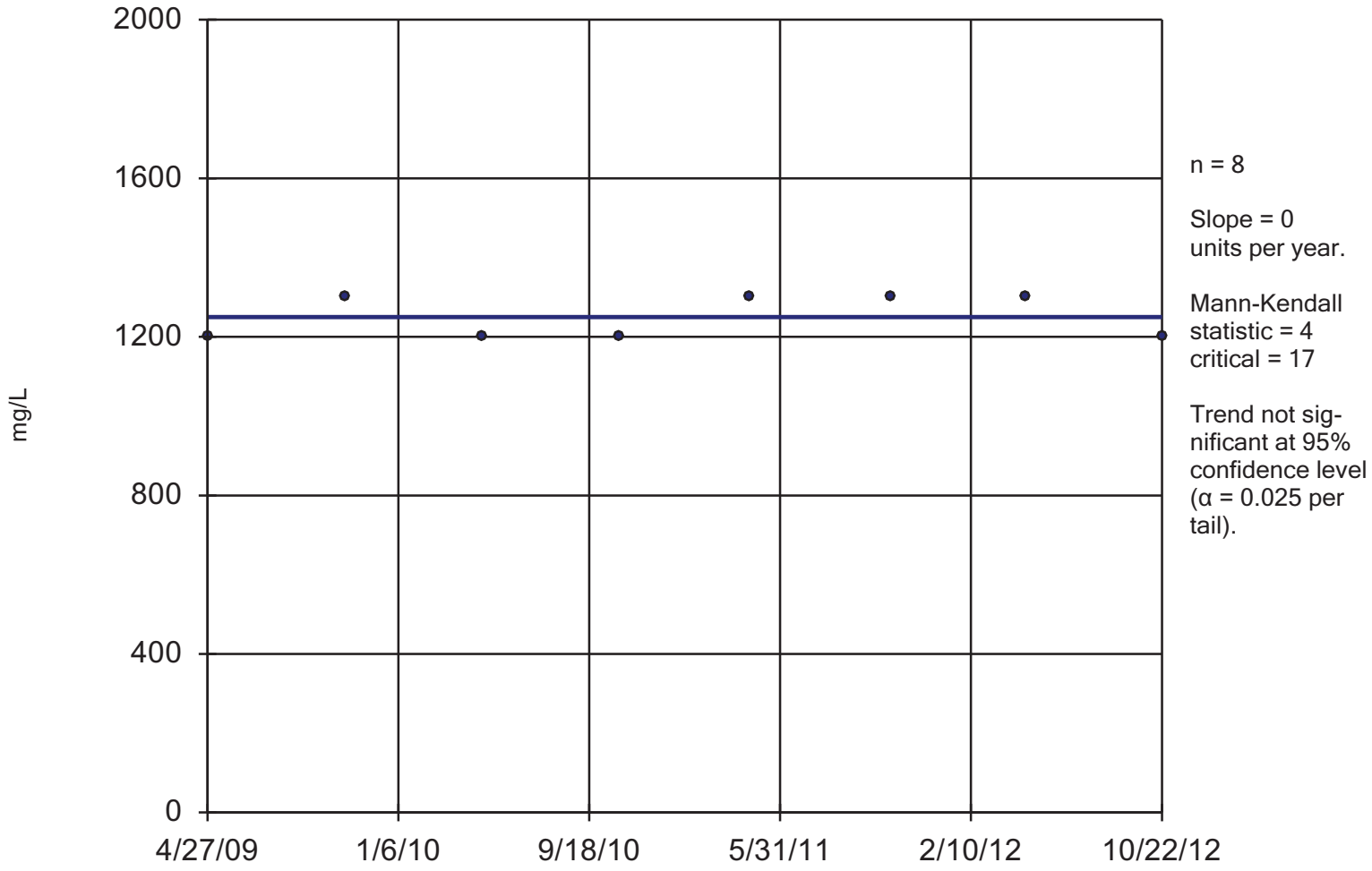



Constituent: Sodium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-13D (bg)

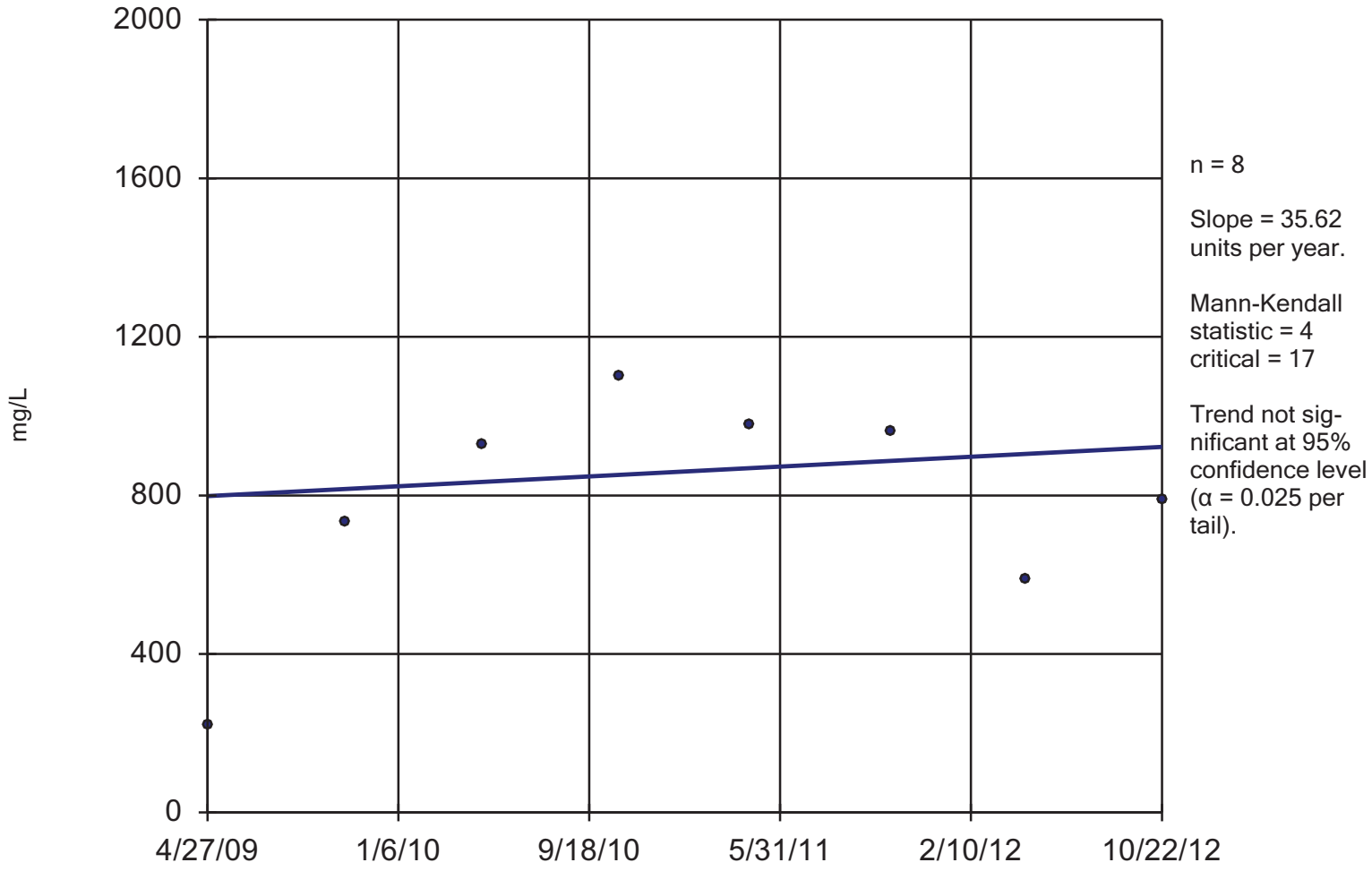



Constituent: Sodium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-13S (bg)

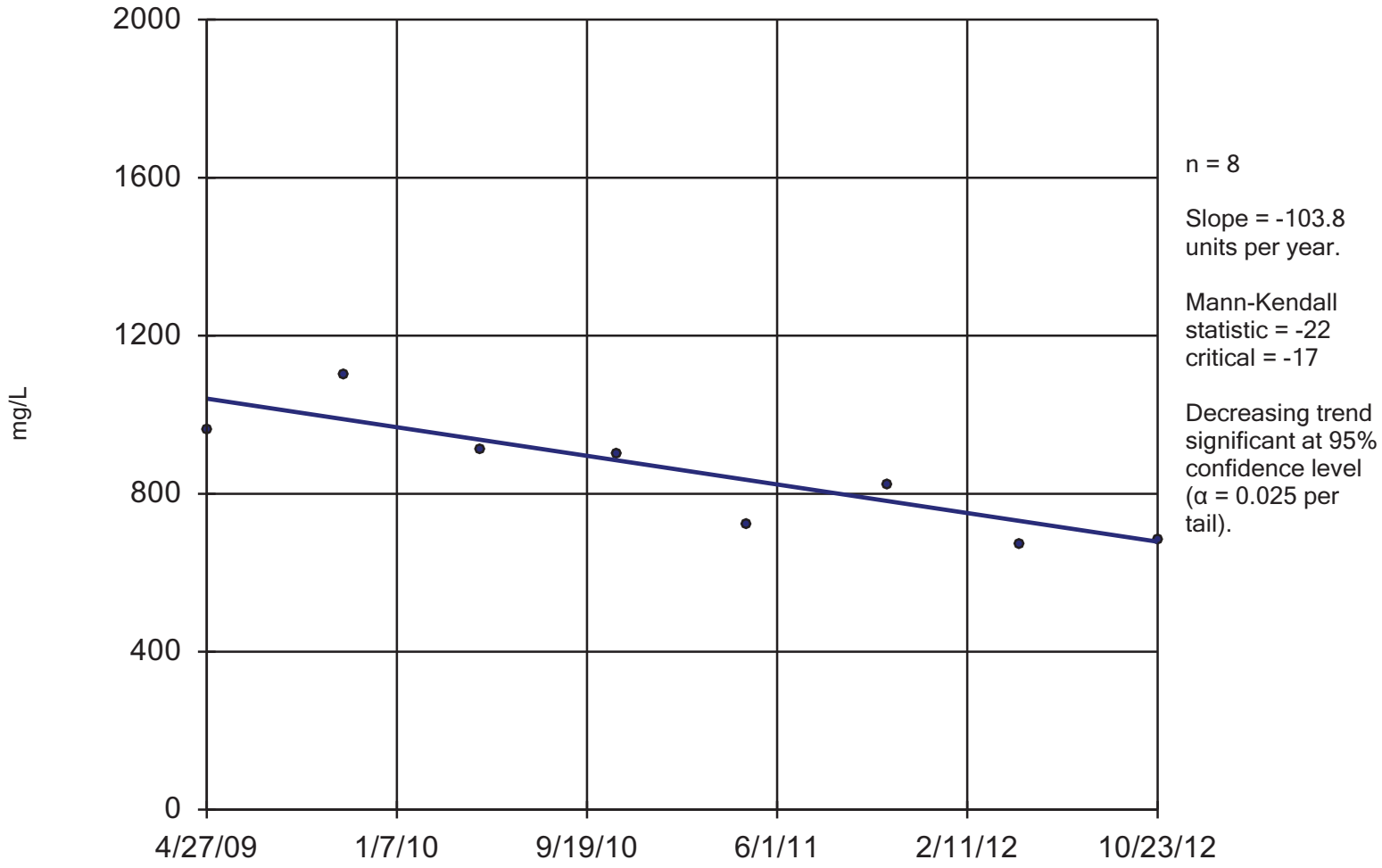



Constituent: Sodium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-14D (bg)

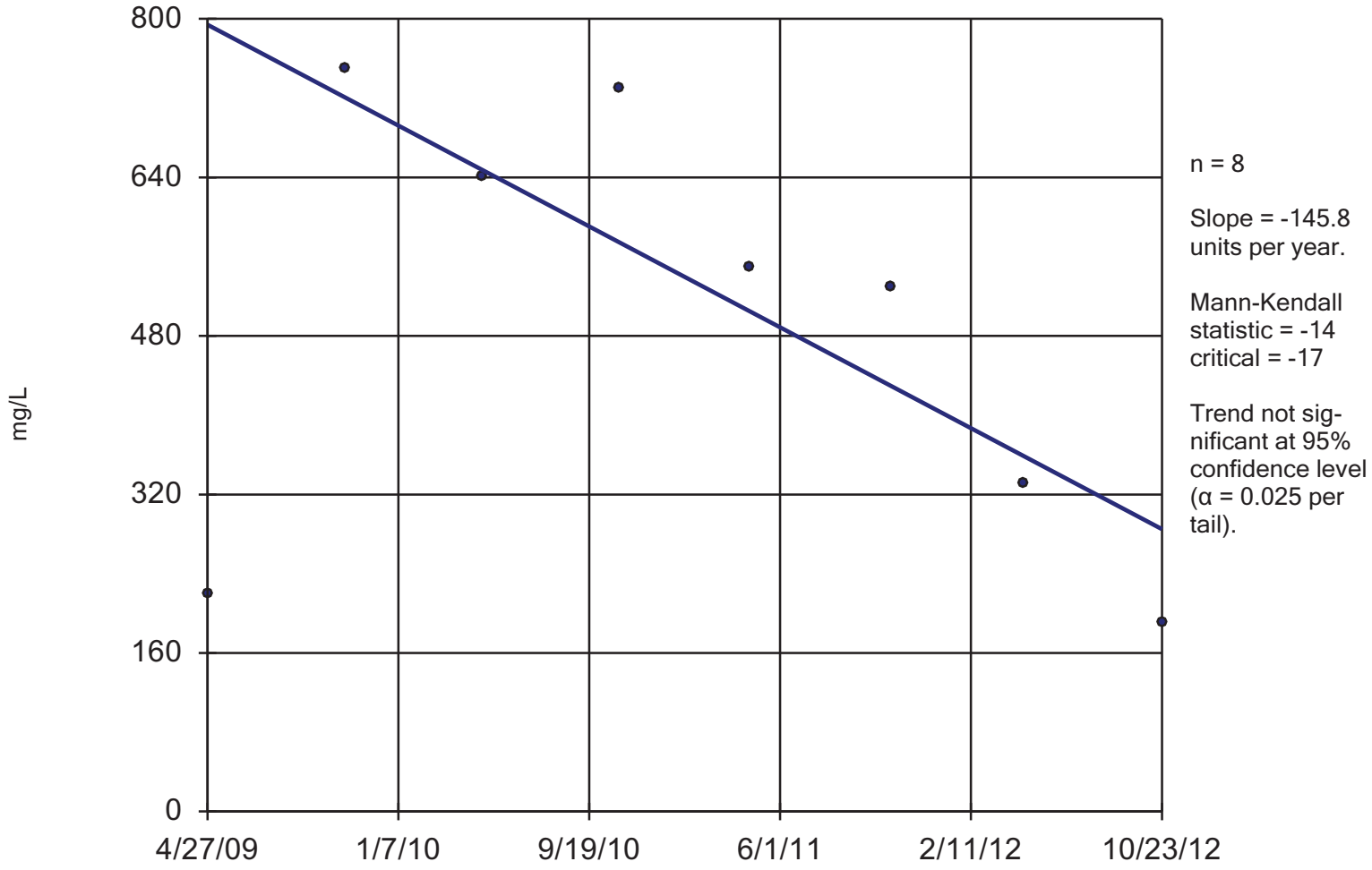



Constituent: Sodium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

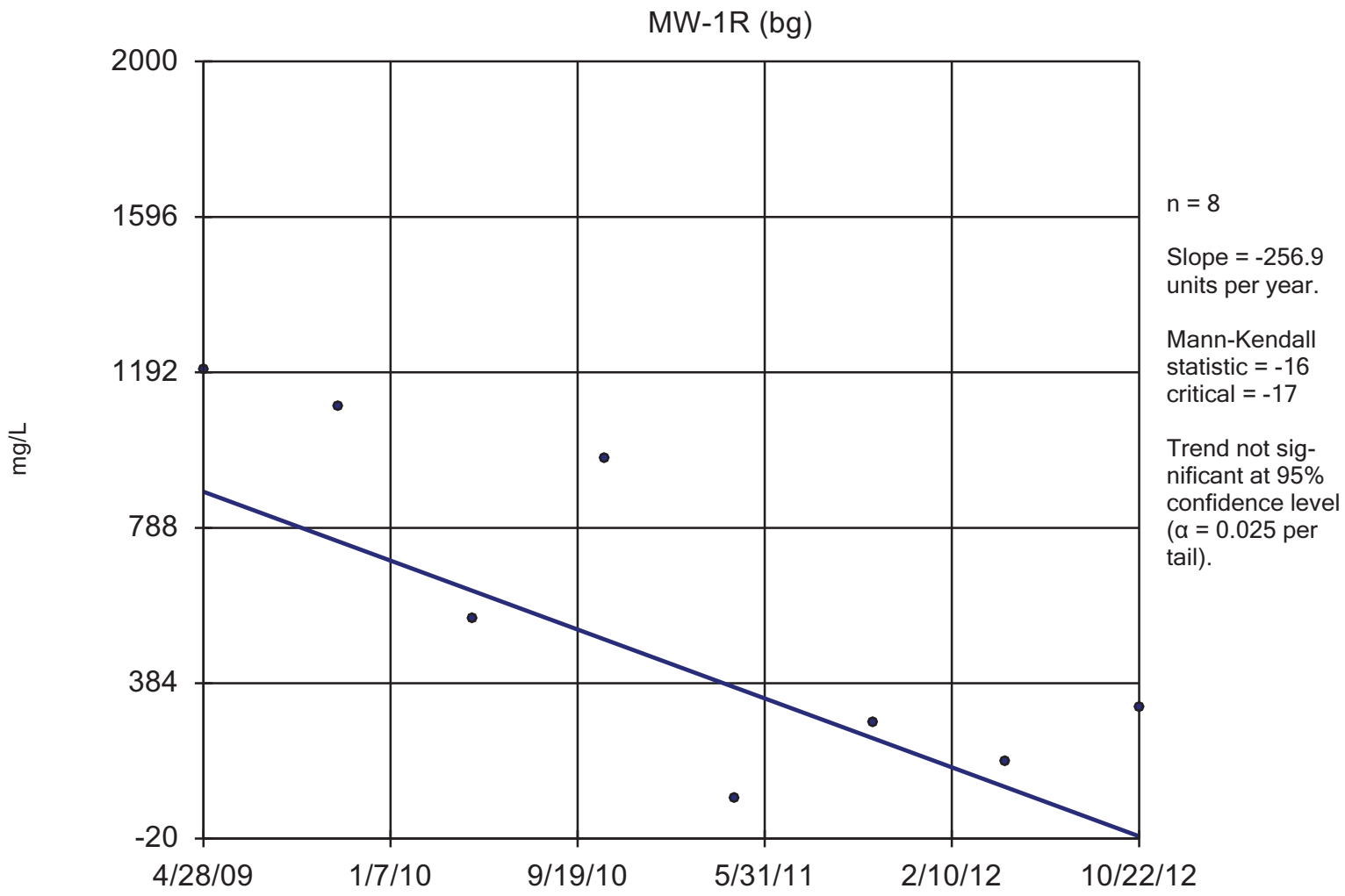
## MW-14S (bg)




Constituent: Sodium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

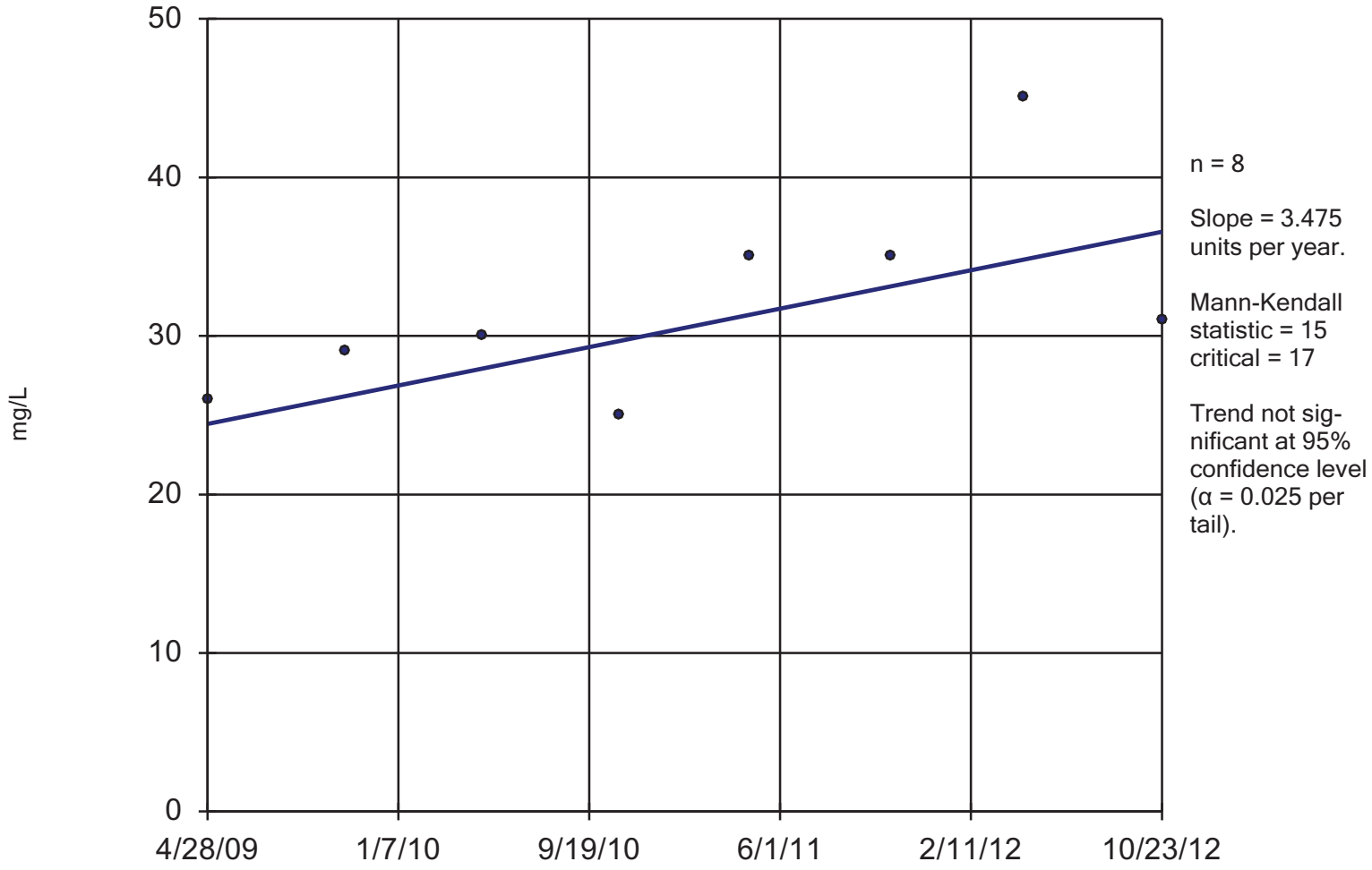



Constituent: Sodium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-6

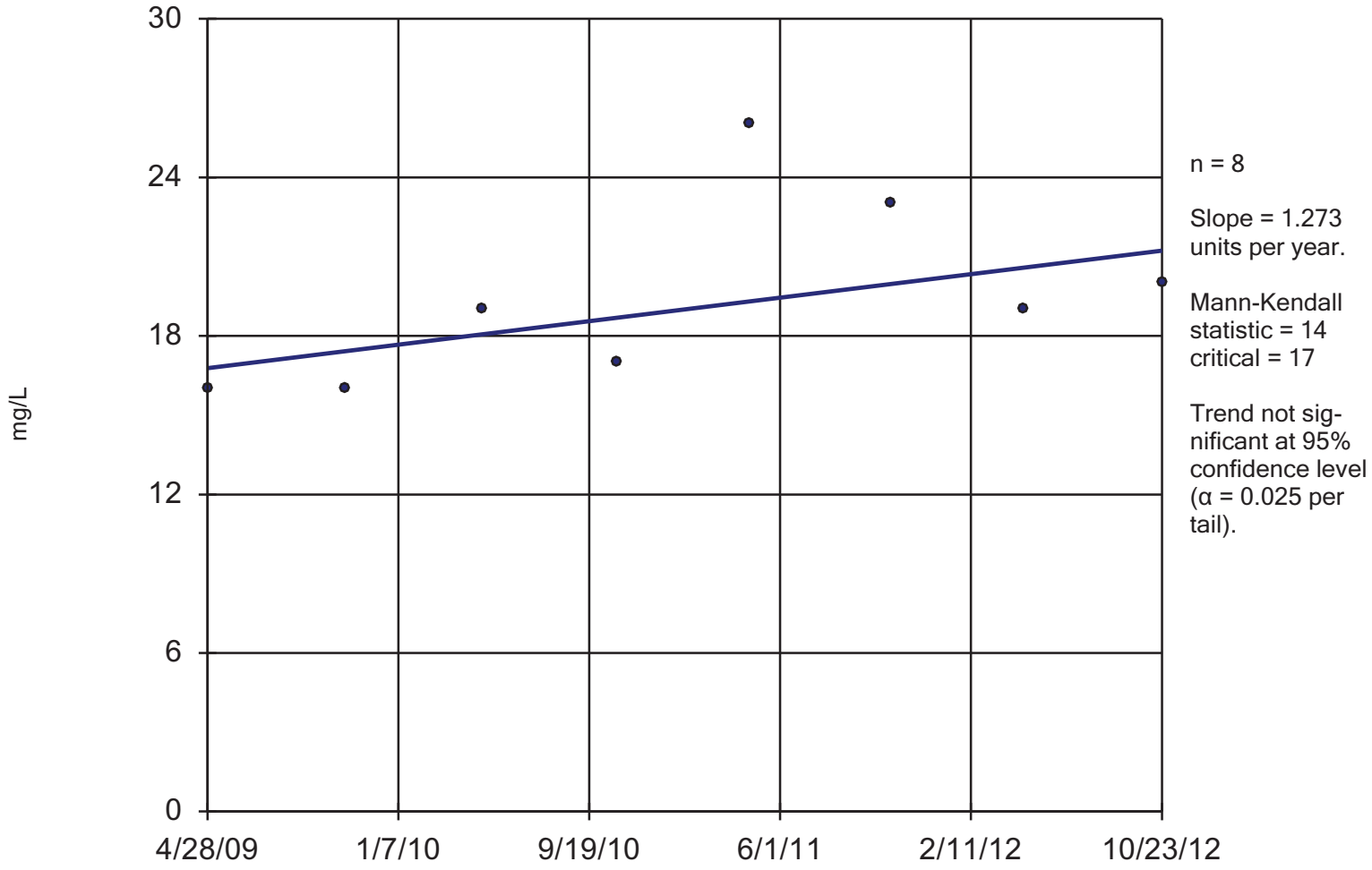



Constituent: Sodium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-7

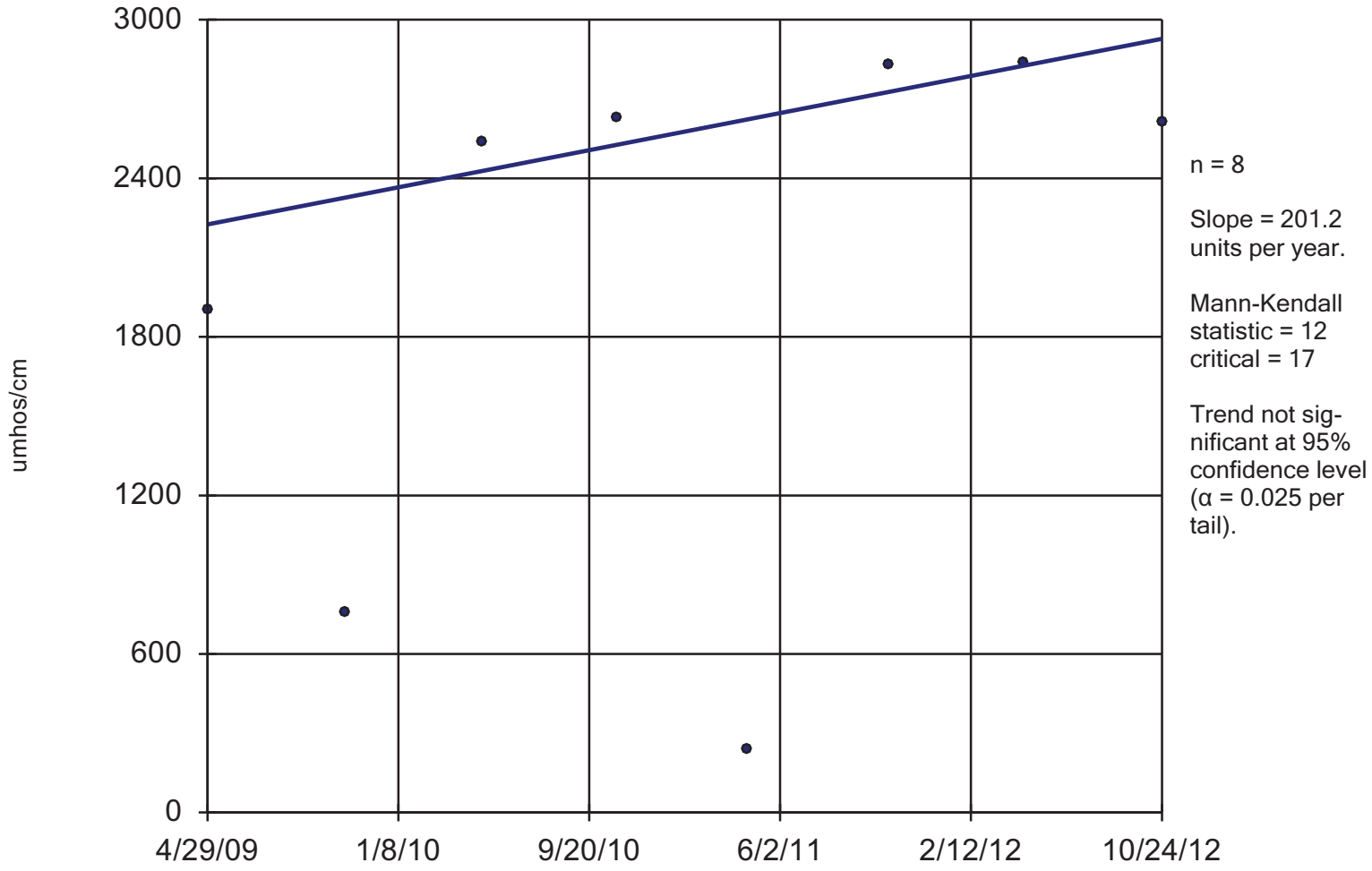



Constituent: Sodium, dissolved  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-10




n = 8

Slope = 201.2 units per year.

Mann-Kendall statistic = 12
critical = 17

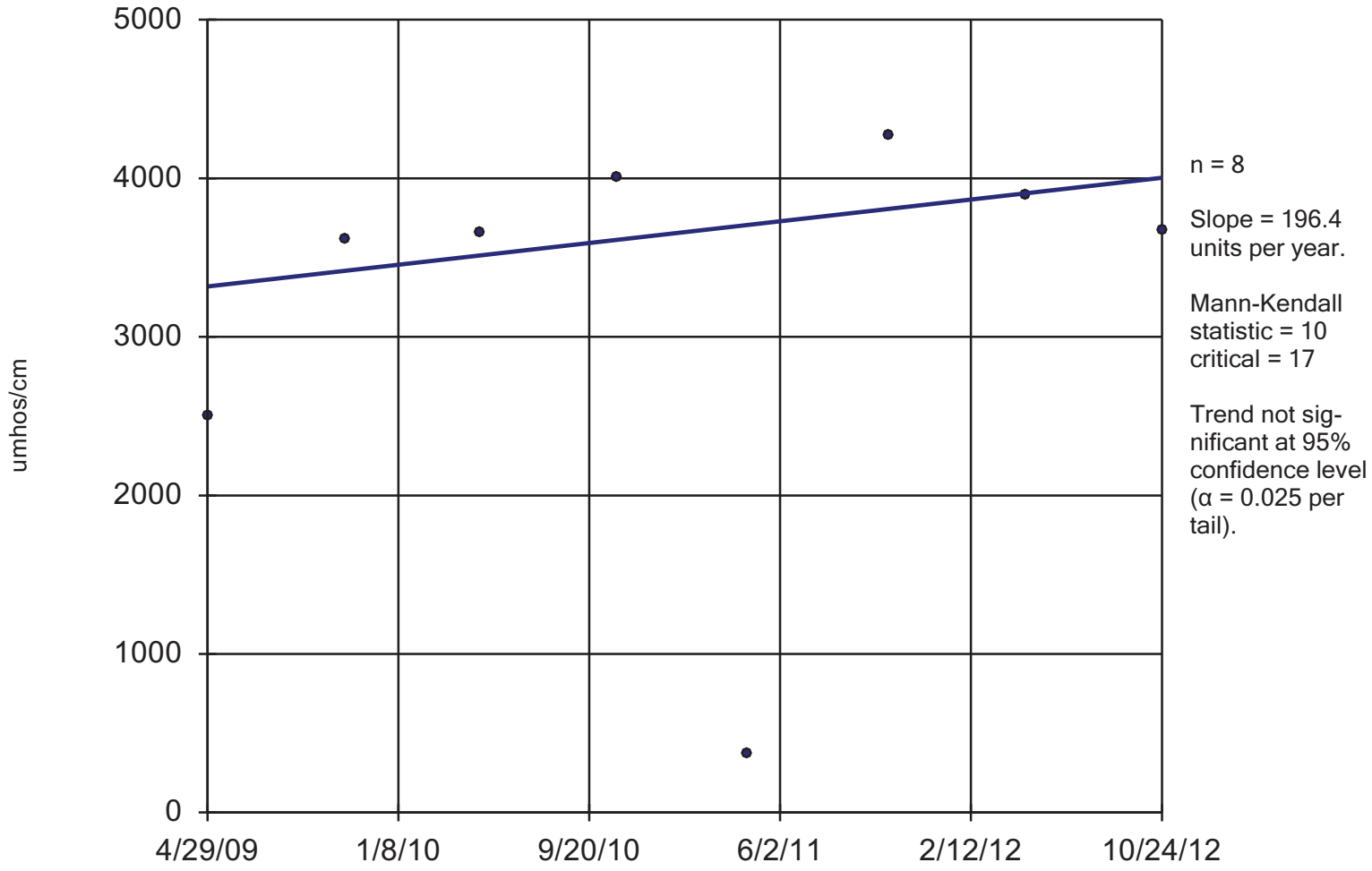
Trend not significant at 95% confidence level (α = 0.025 per tail).

Constituent: Specific Conductivity, Field  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-11

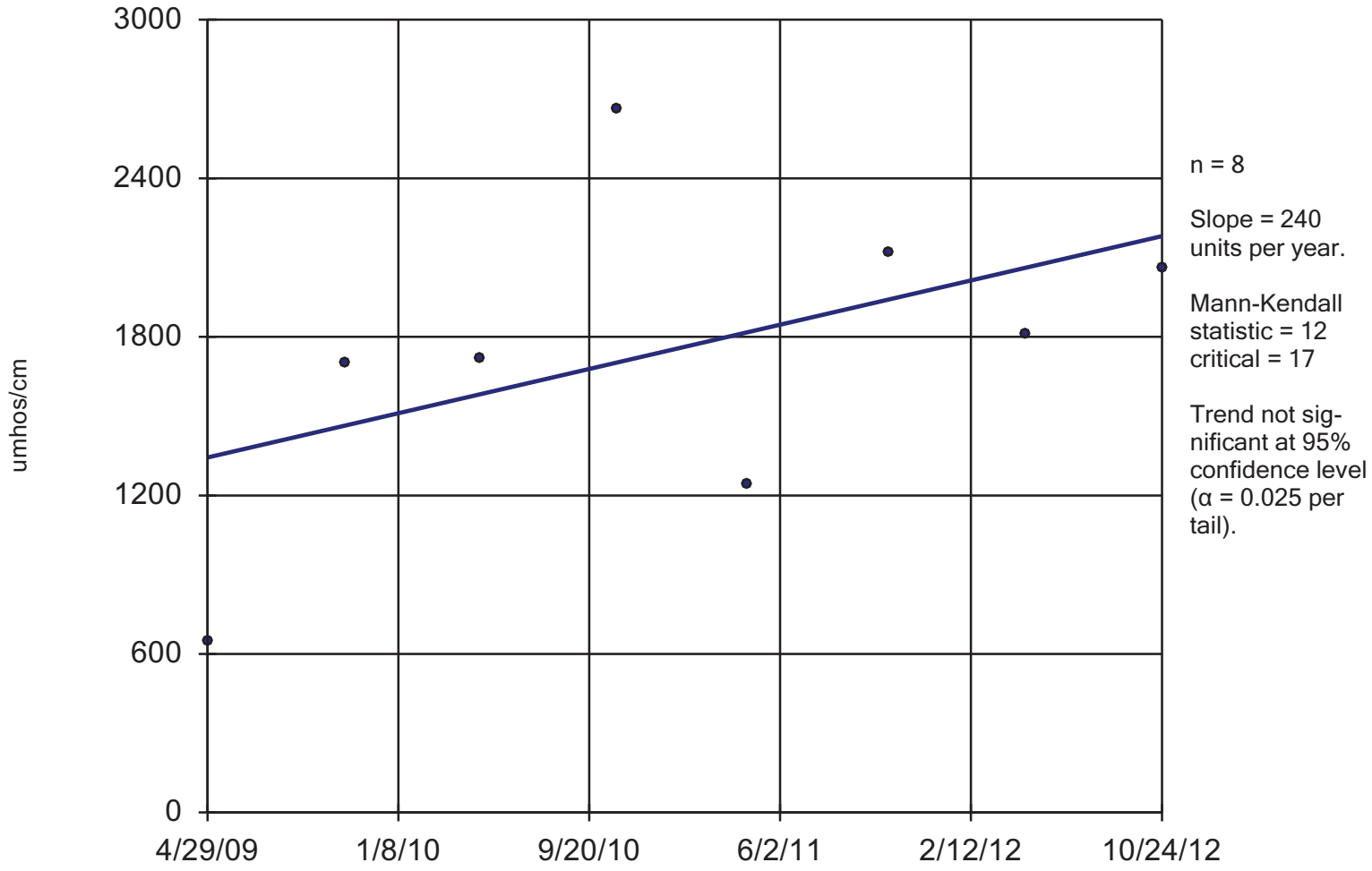



Constituent: Specific Conductivity, Field  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

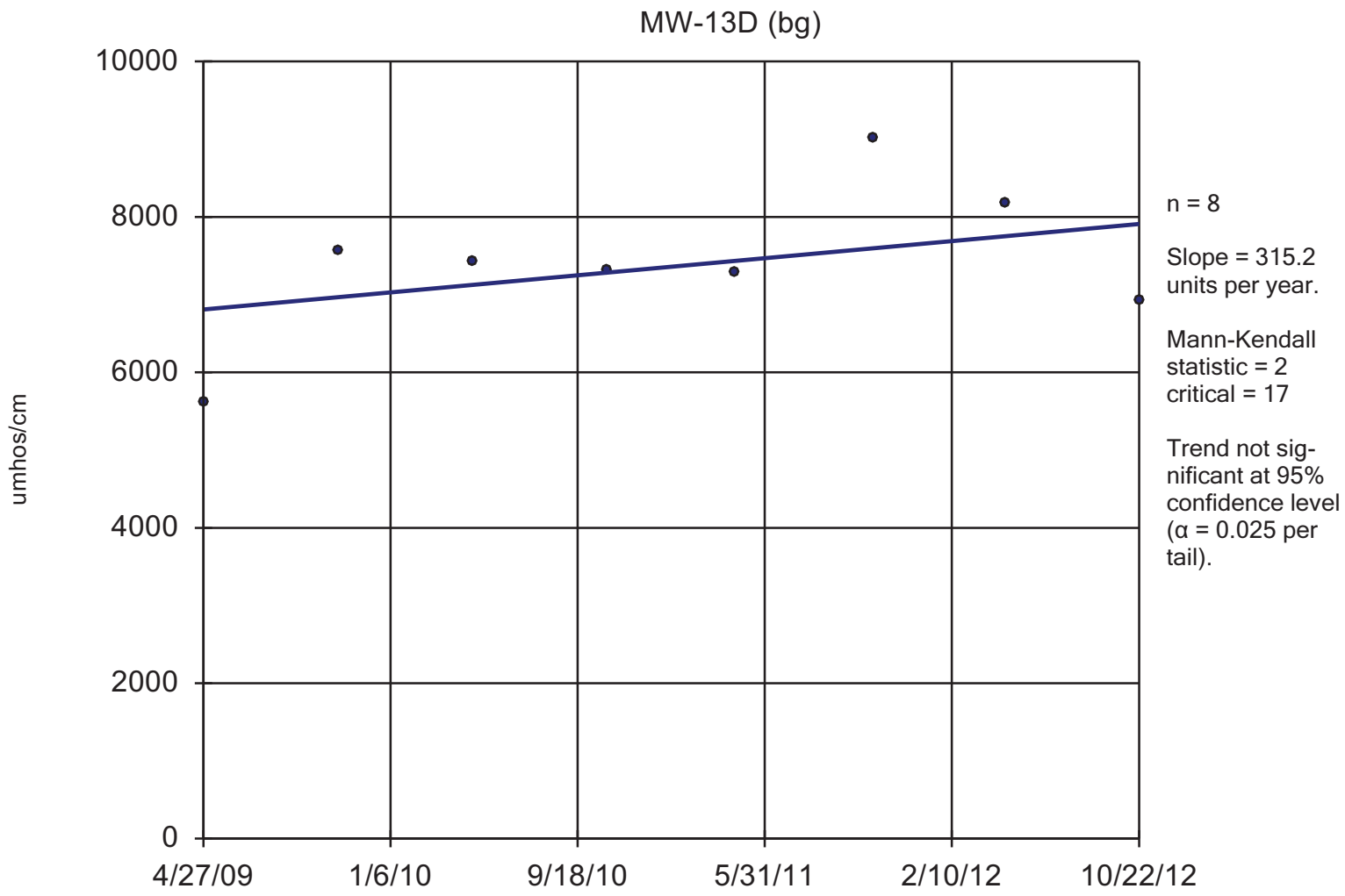
## MW-8




Constituent: Specific Conductivity, Field  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

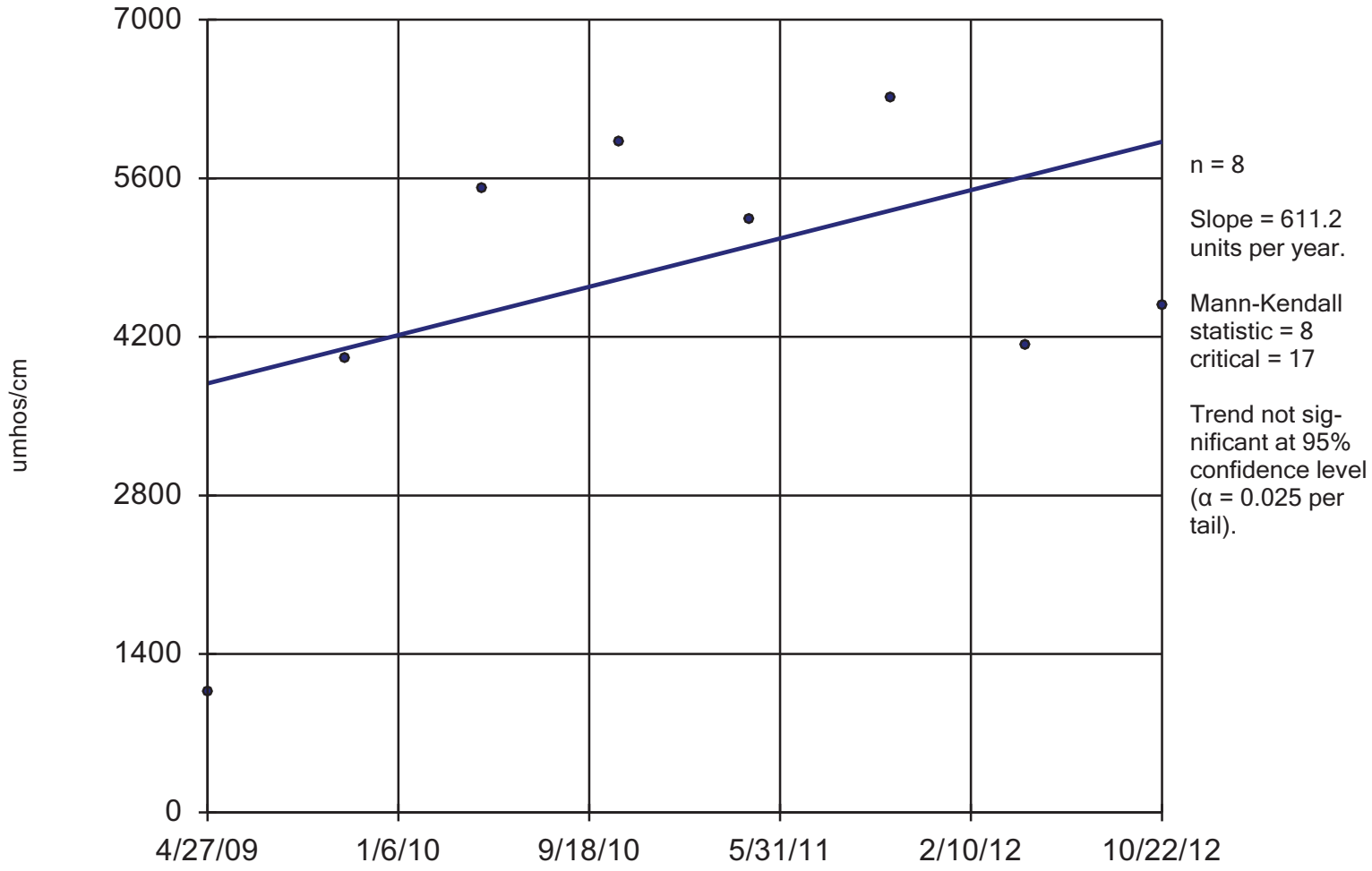



Constituent: Specific Conductivity, Field  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-13S (bg)

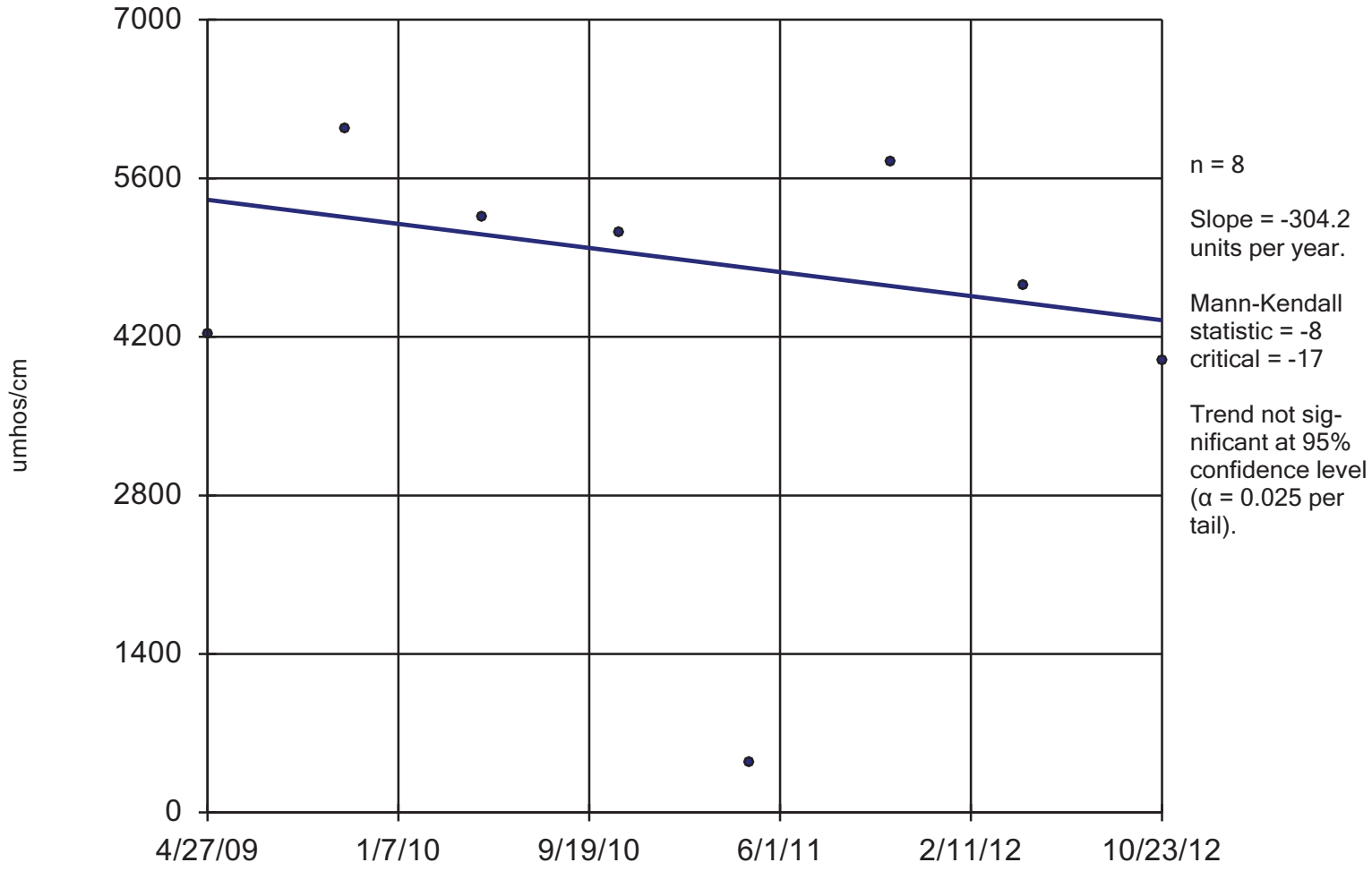



Constituent: Specific Conductivity, Field  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-14D (bg)

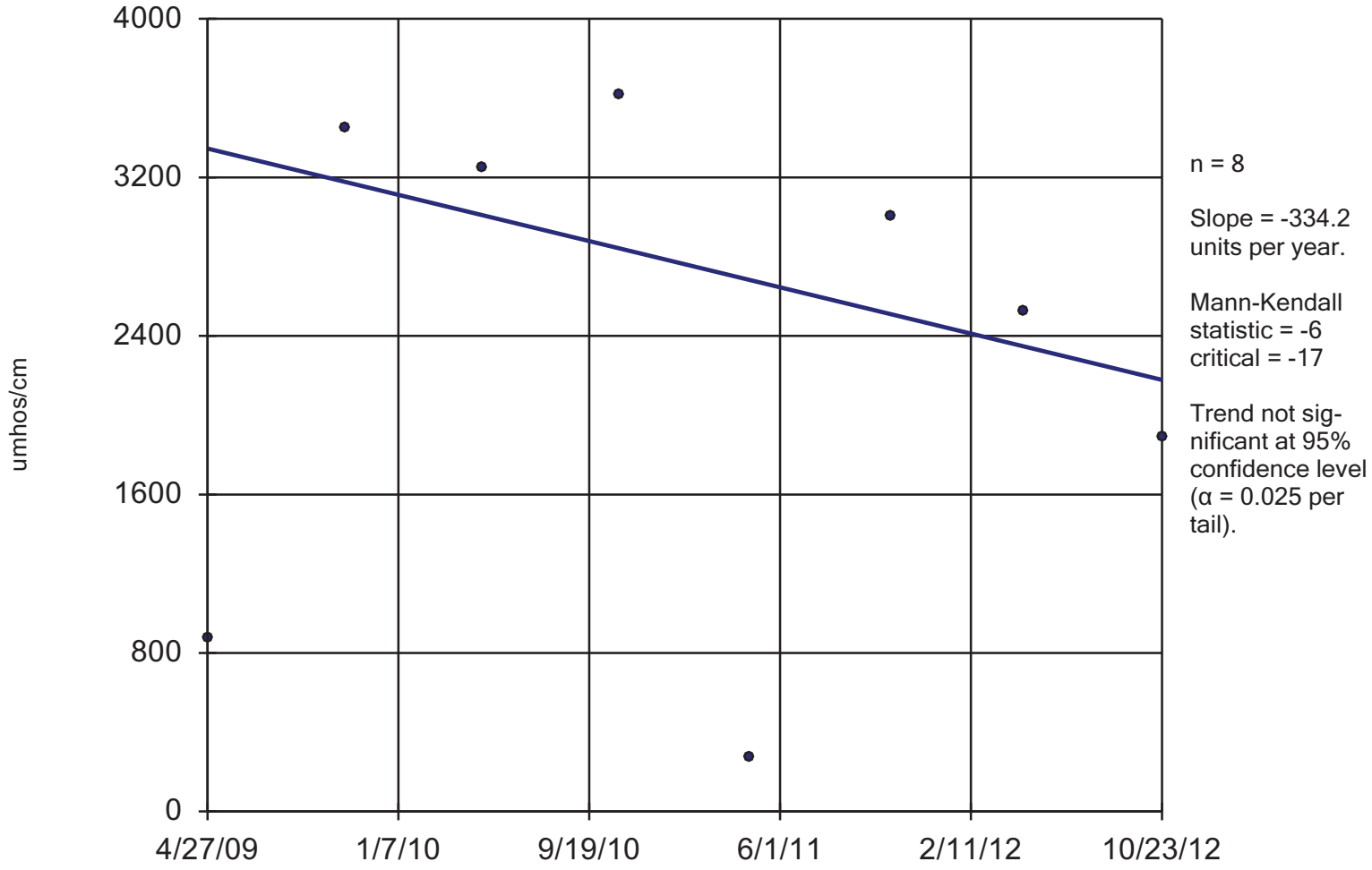



Constituent: Specific Conductivity, Field  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-14S (bg)

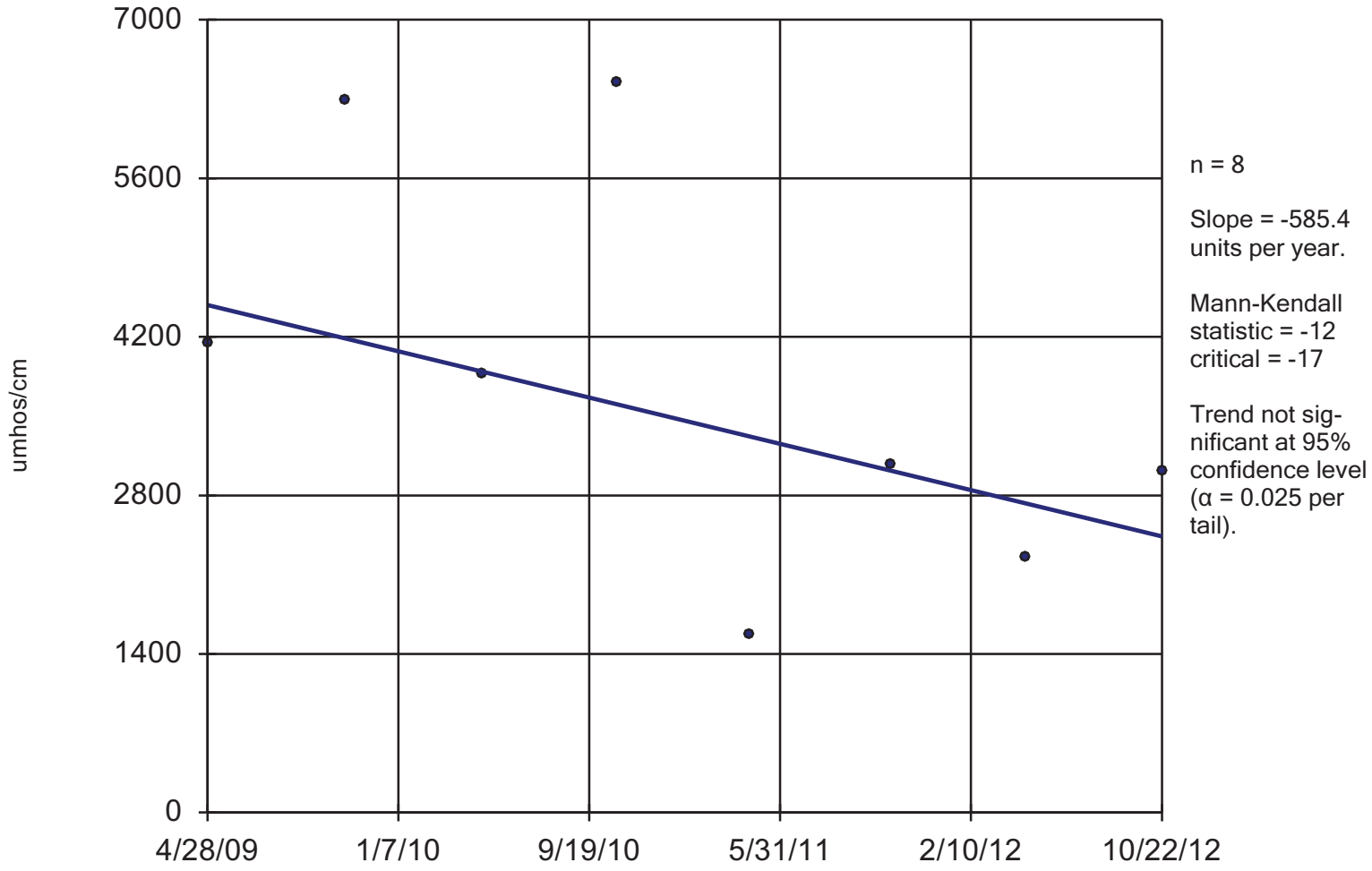



Constituent: Specific Conductivity, Field  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-1R (bg)

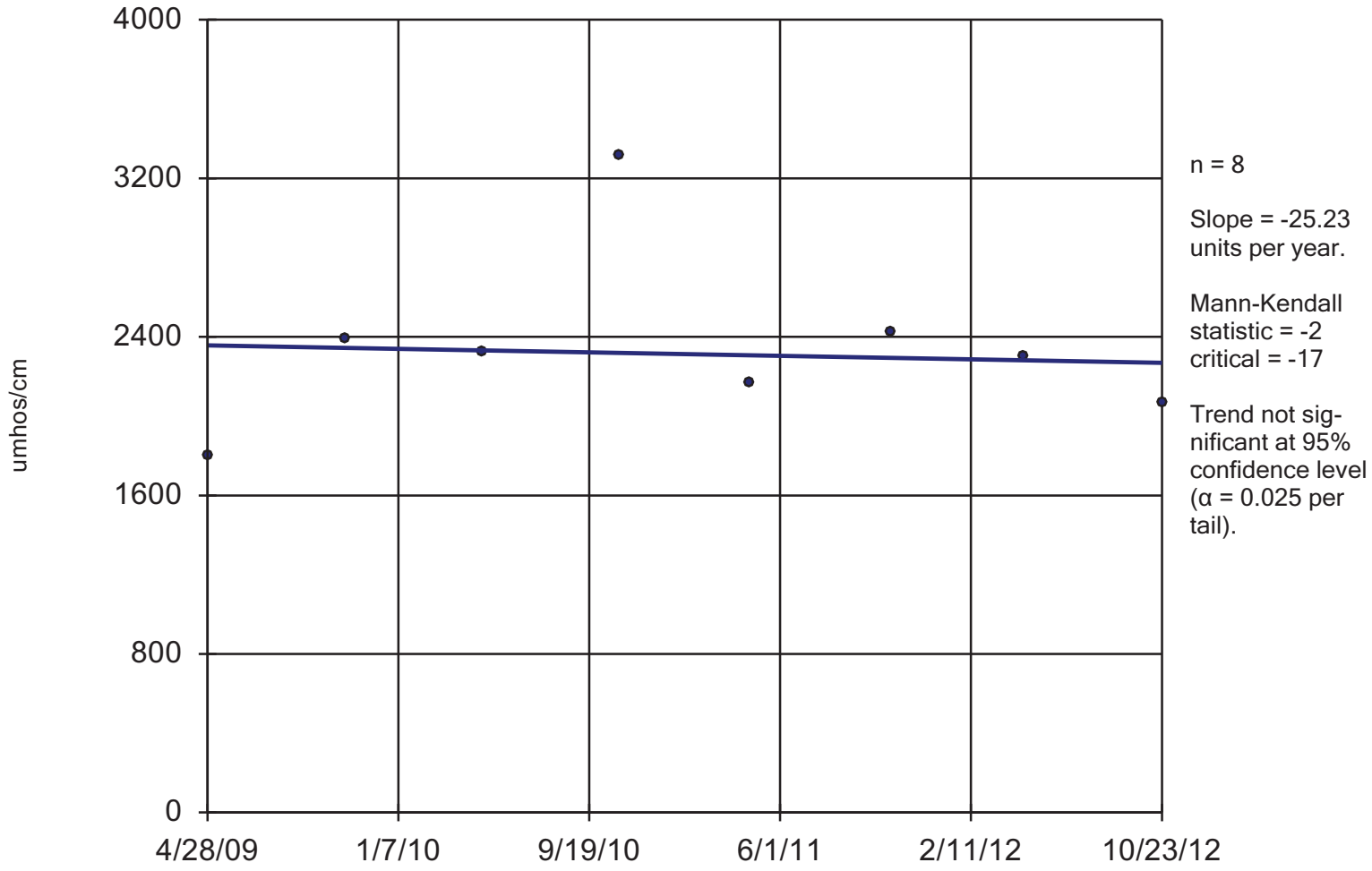



Constituent: Specific Conductivity, Field  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-6

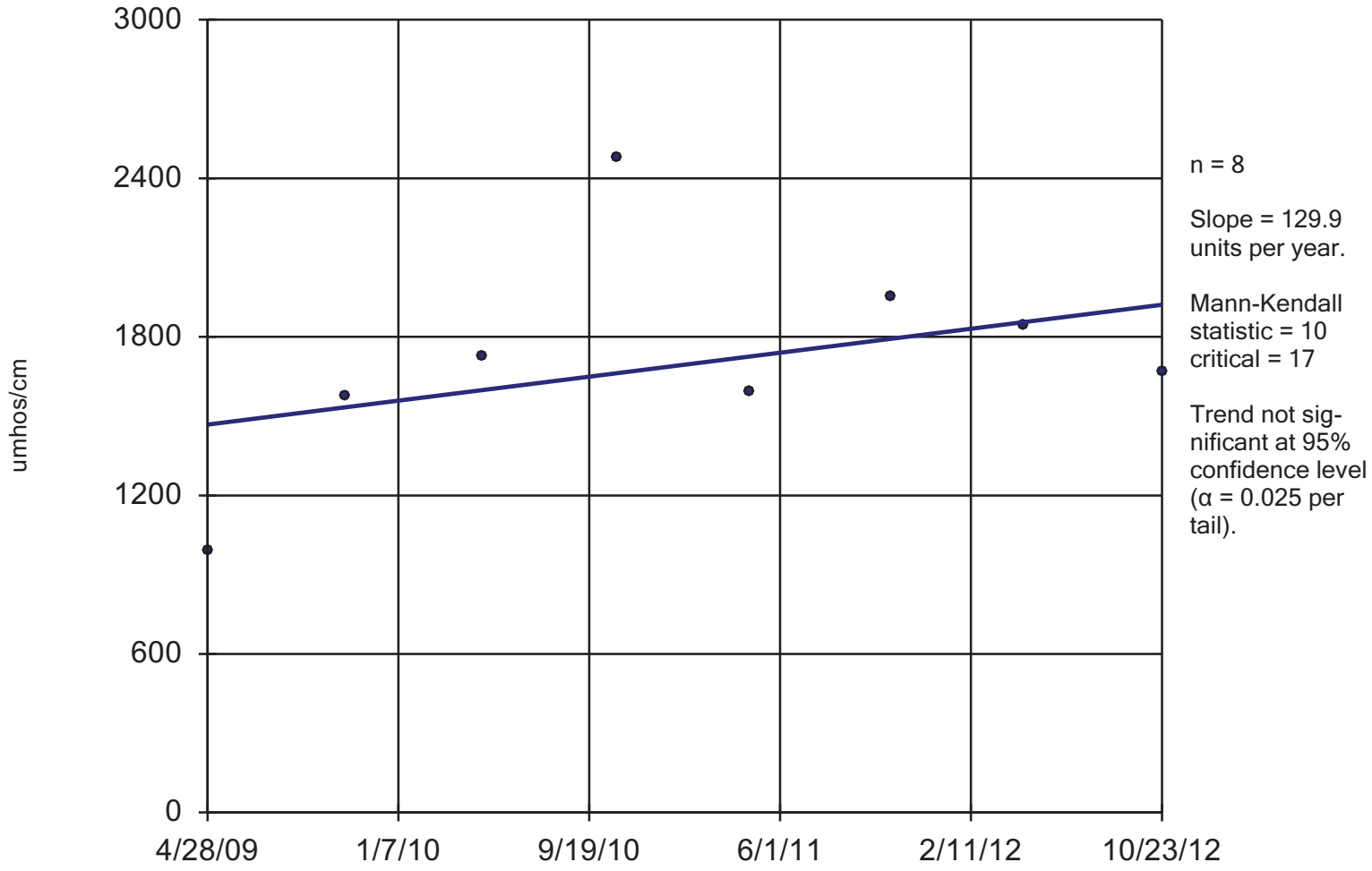



Constituent: Specific Conductivity, Field  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-7

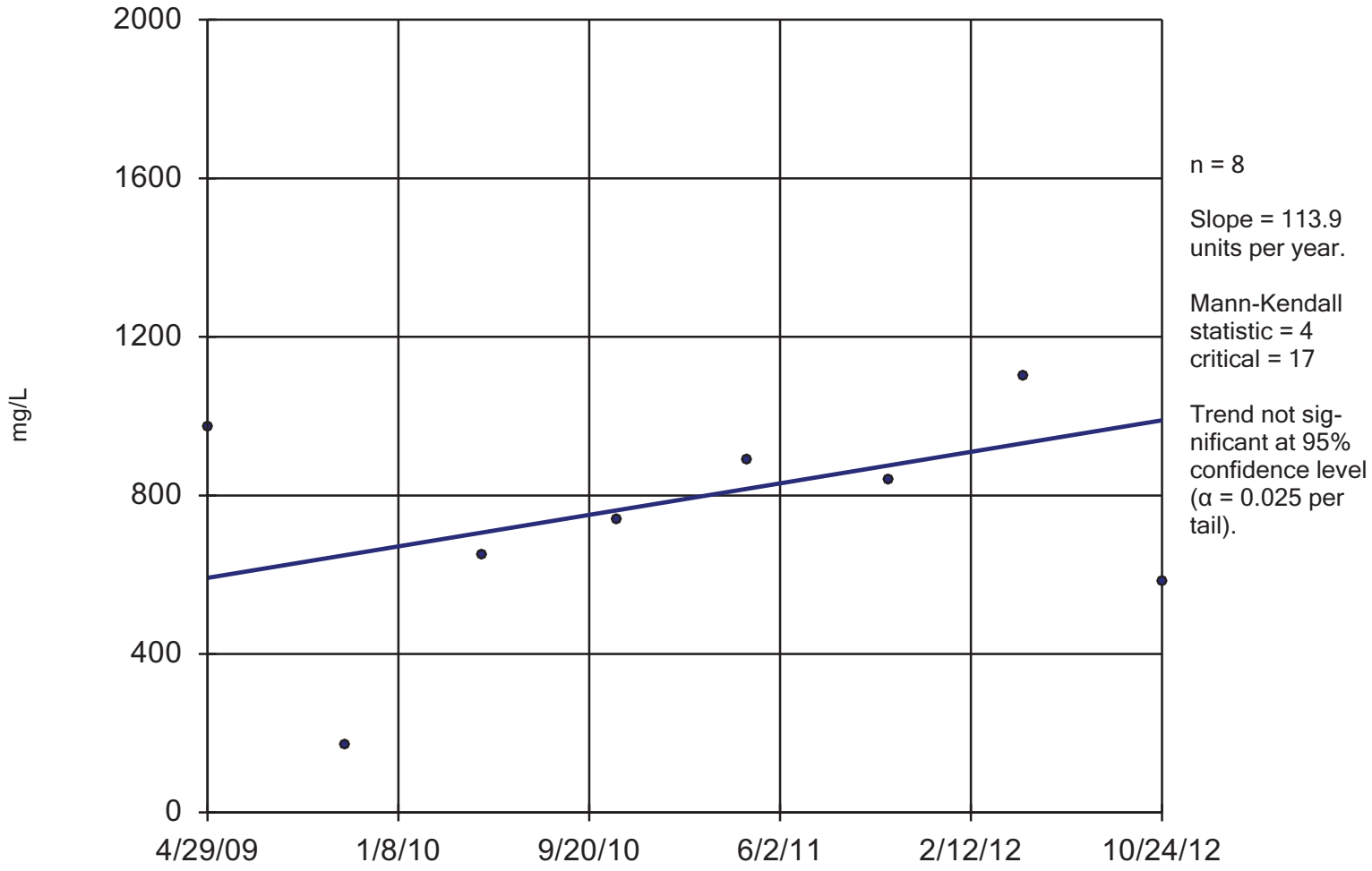



Constituent: Specific Conductivity, Field  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

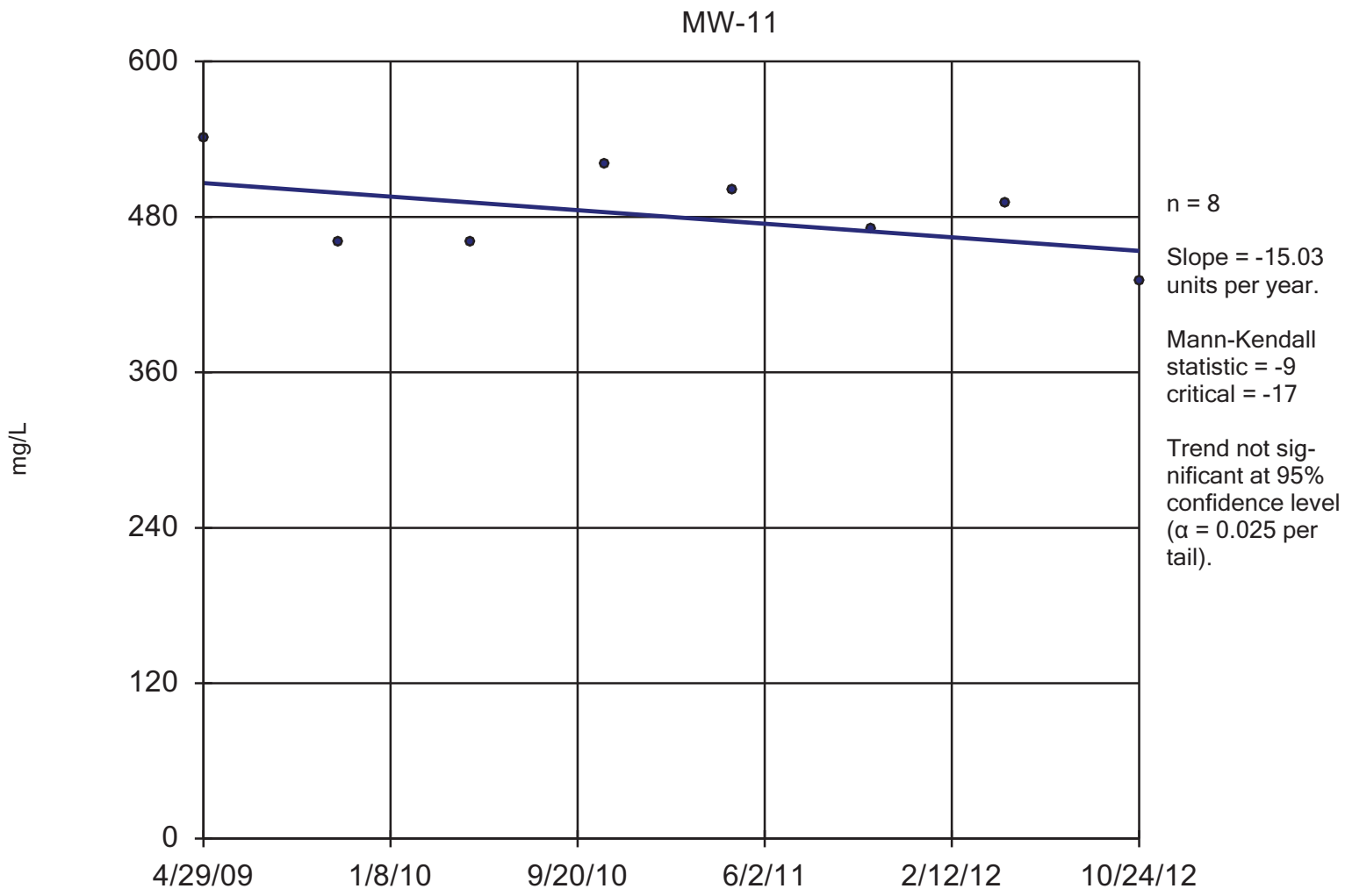
## MW-10




Constituent: Sulfate, total  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

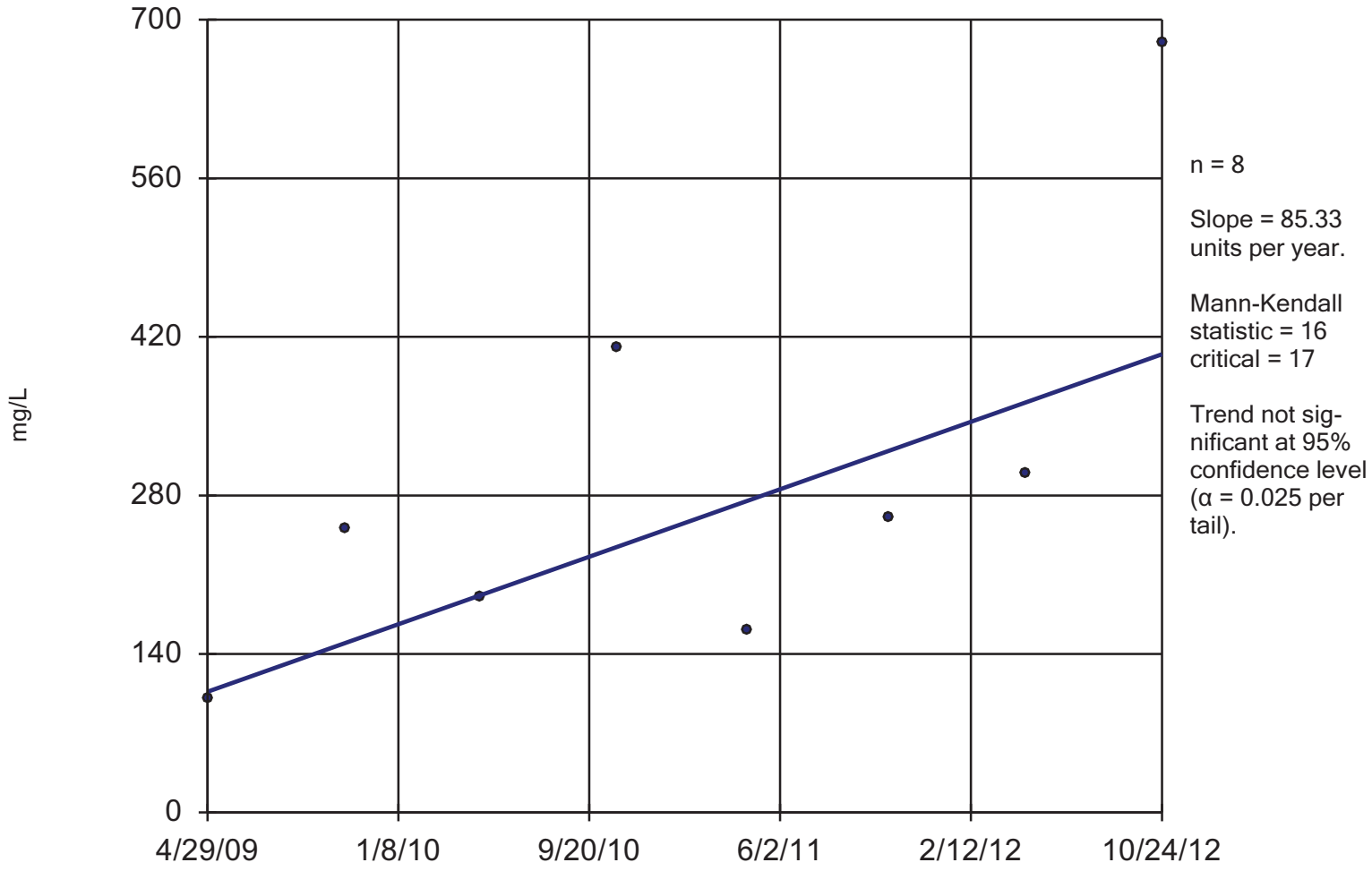



Constituent: Sulfate, total  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

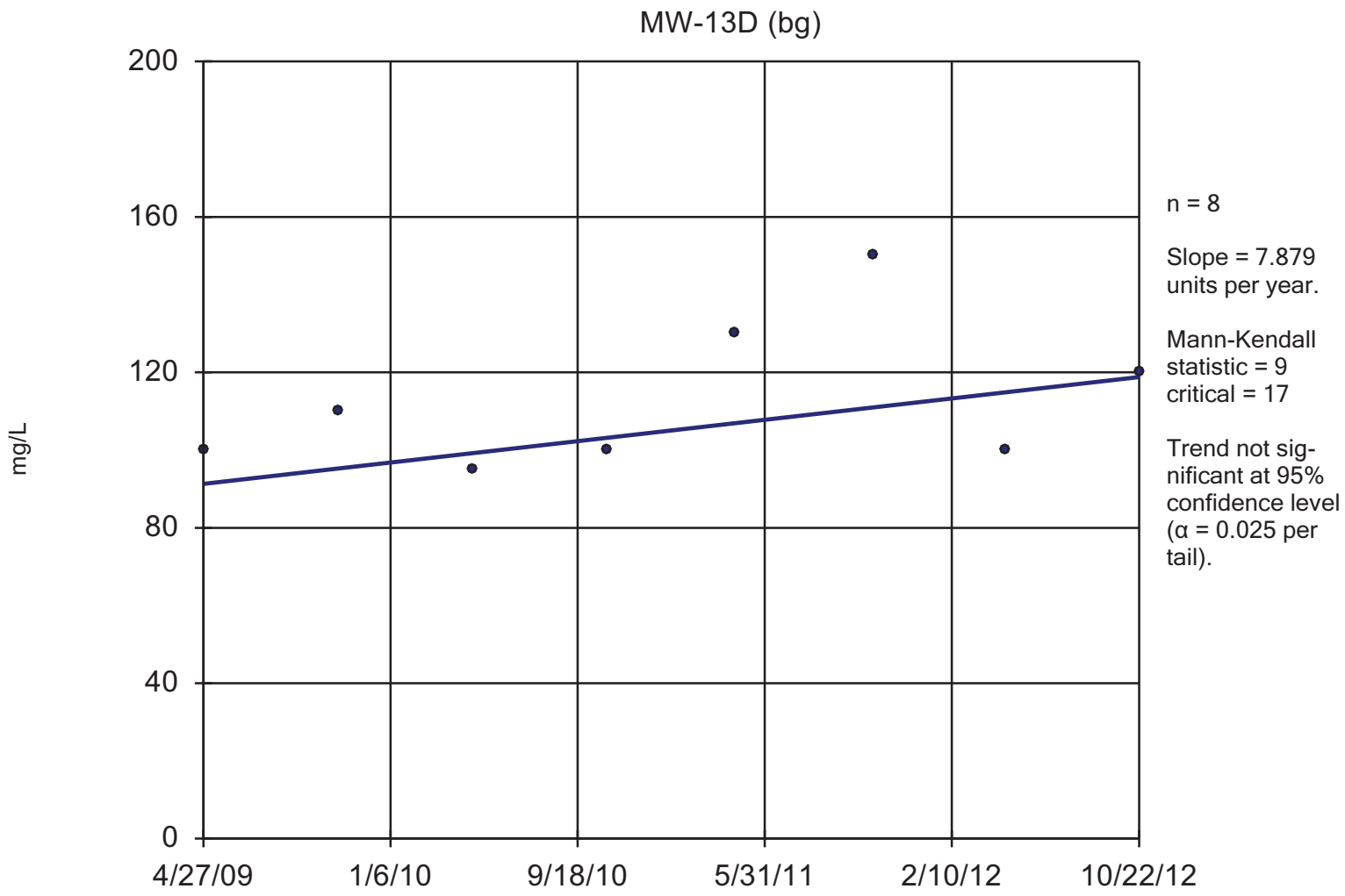
## MW-8




Constituent: Sulfate, total  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

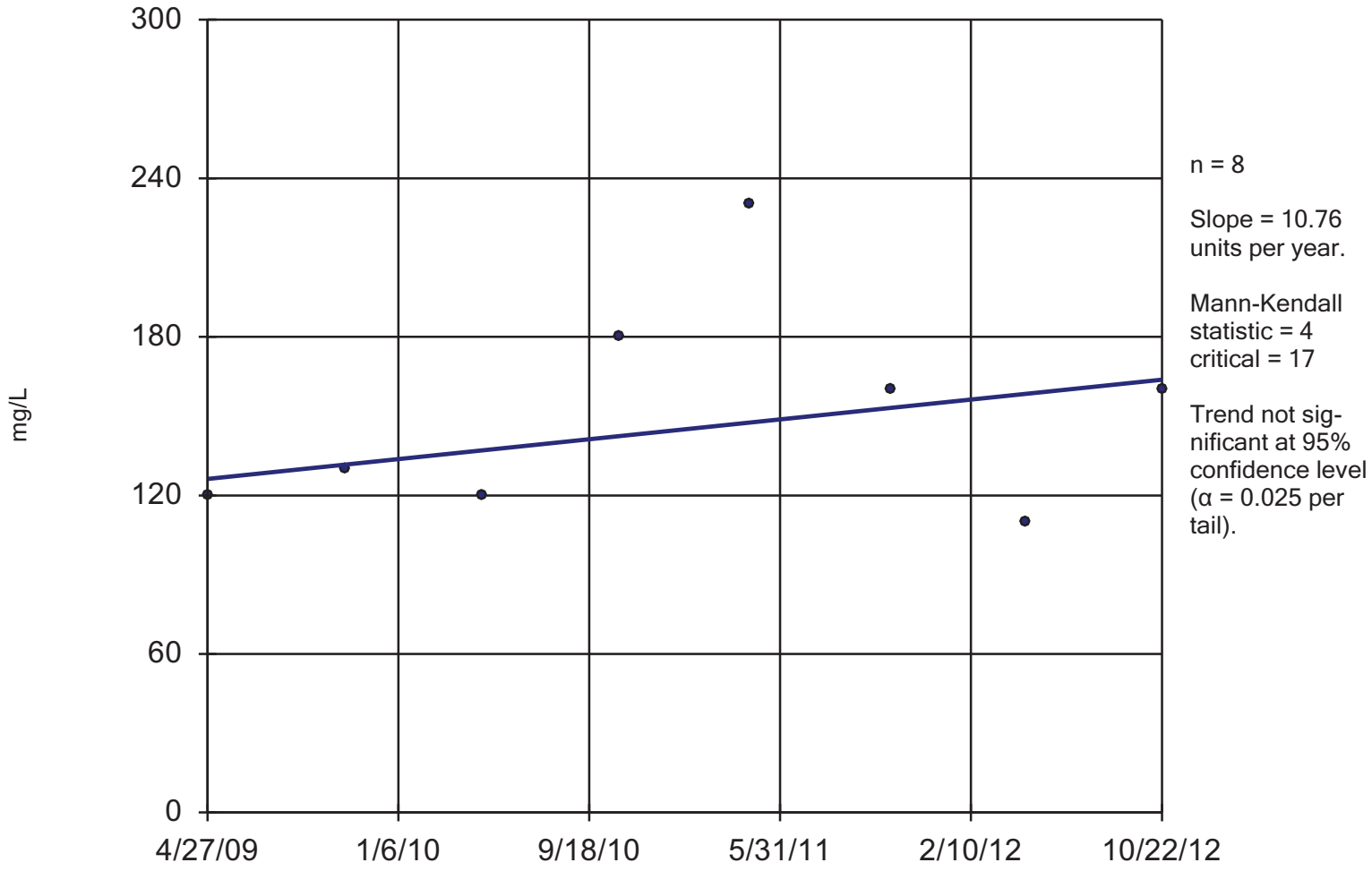



Constituent: Sulfate, total  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

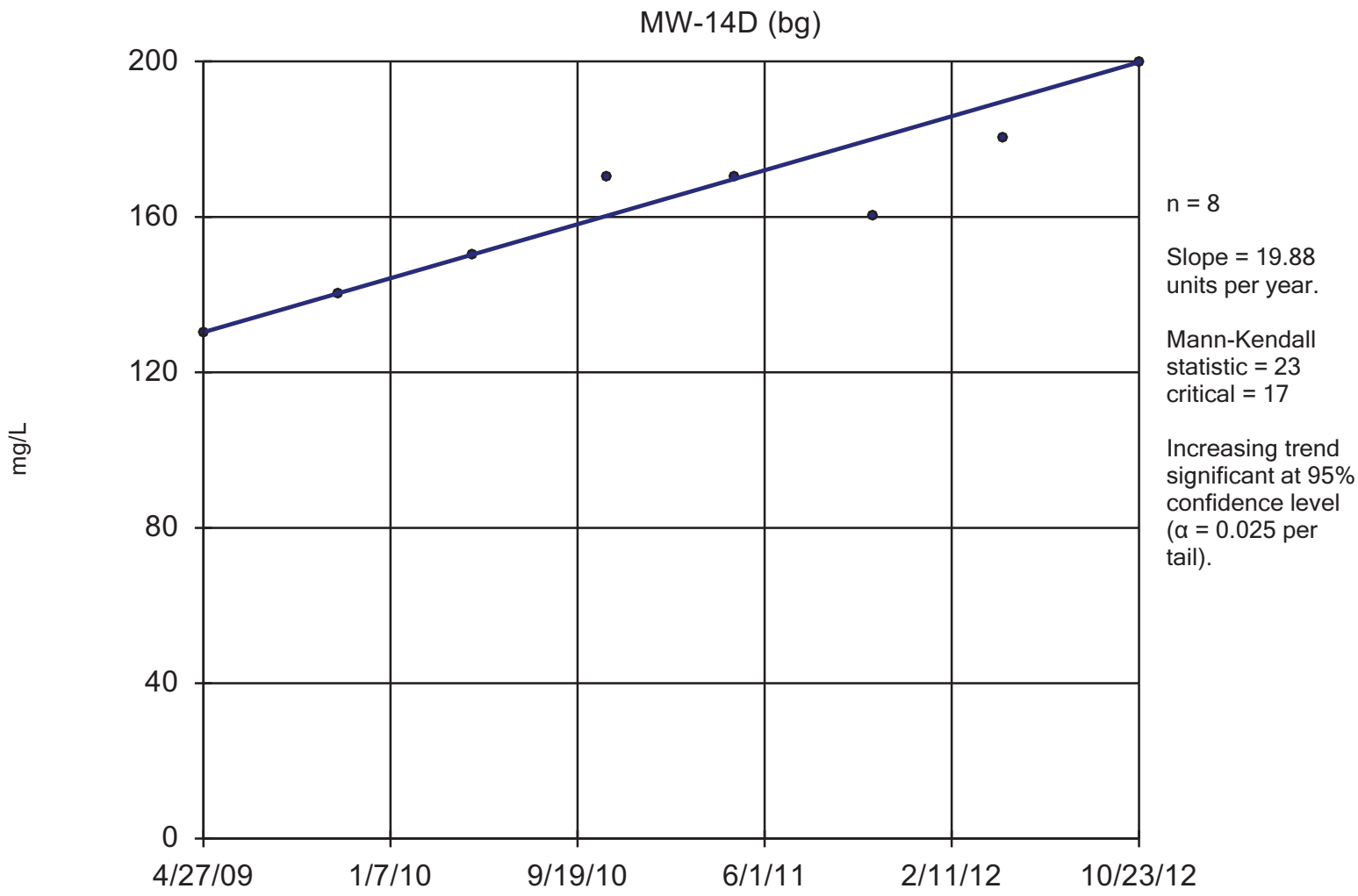
## MW-13S (bg)




Constituent: Sulfate, total  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

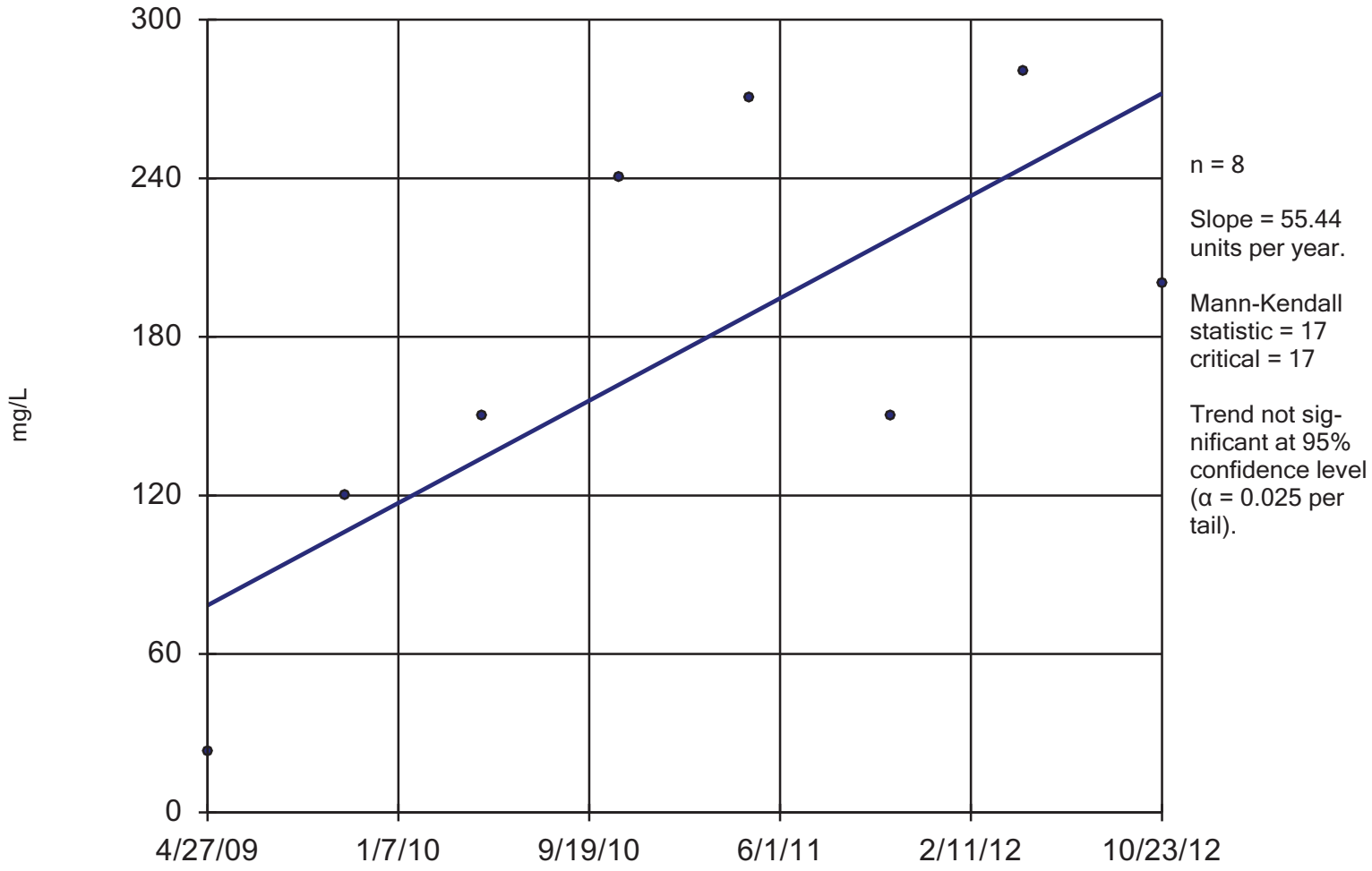



Constituent: Sulfate, total  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

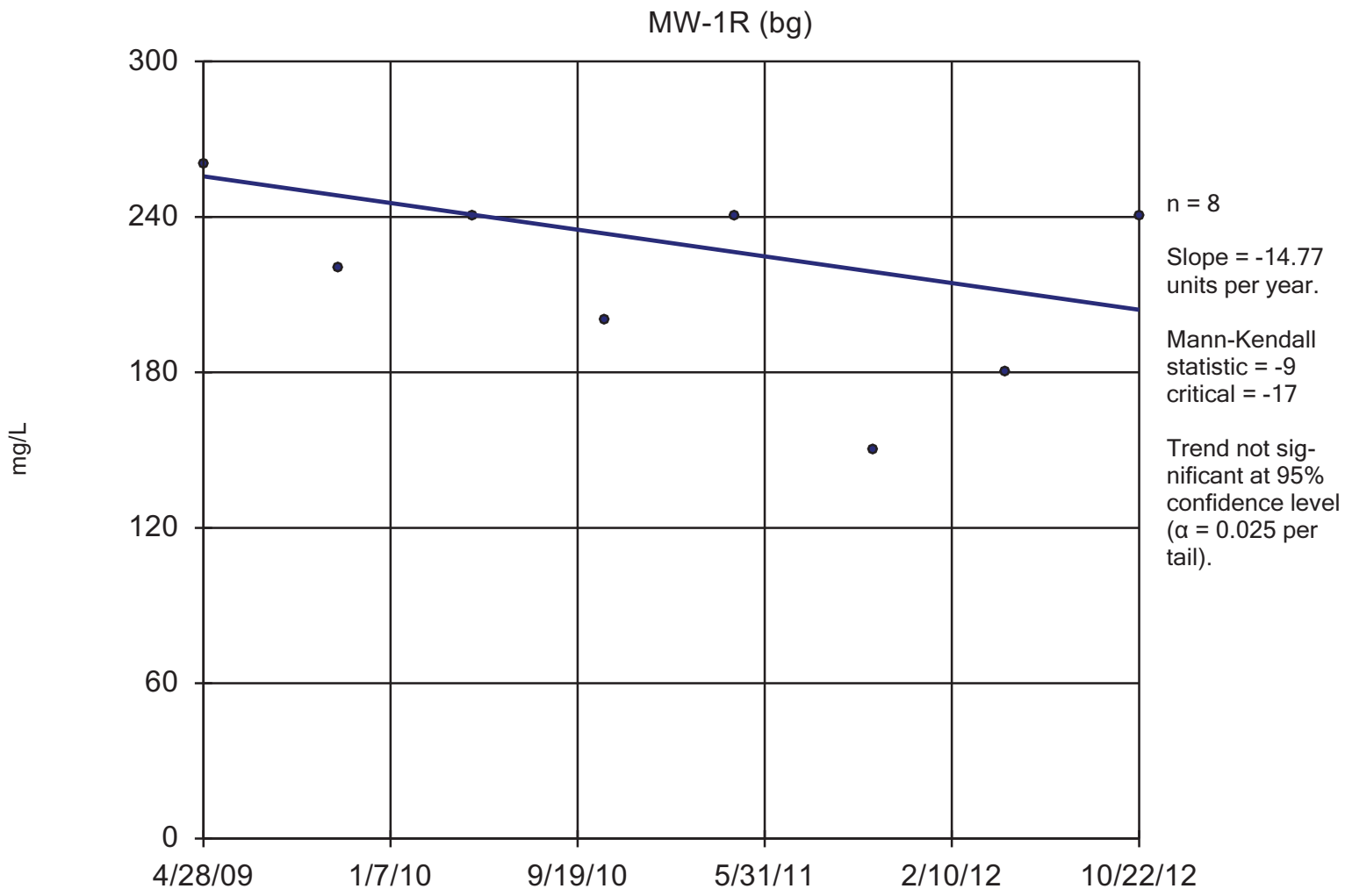
## MW-14S (bg)




Constituent: Sulfate, total  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

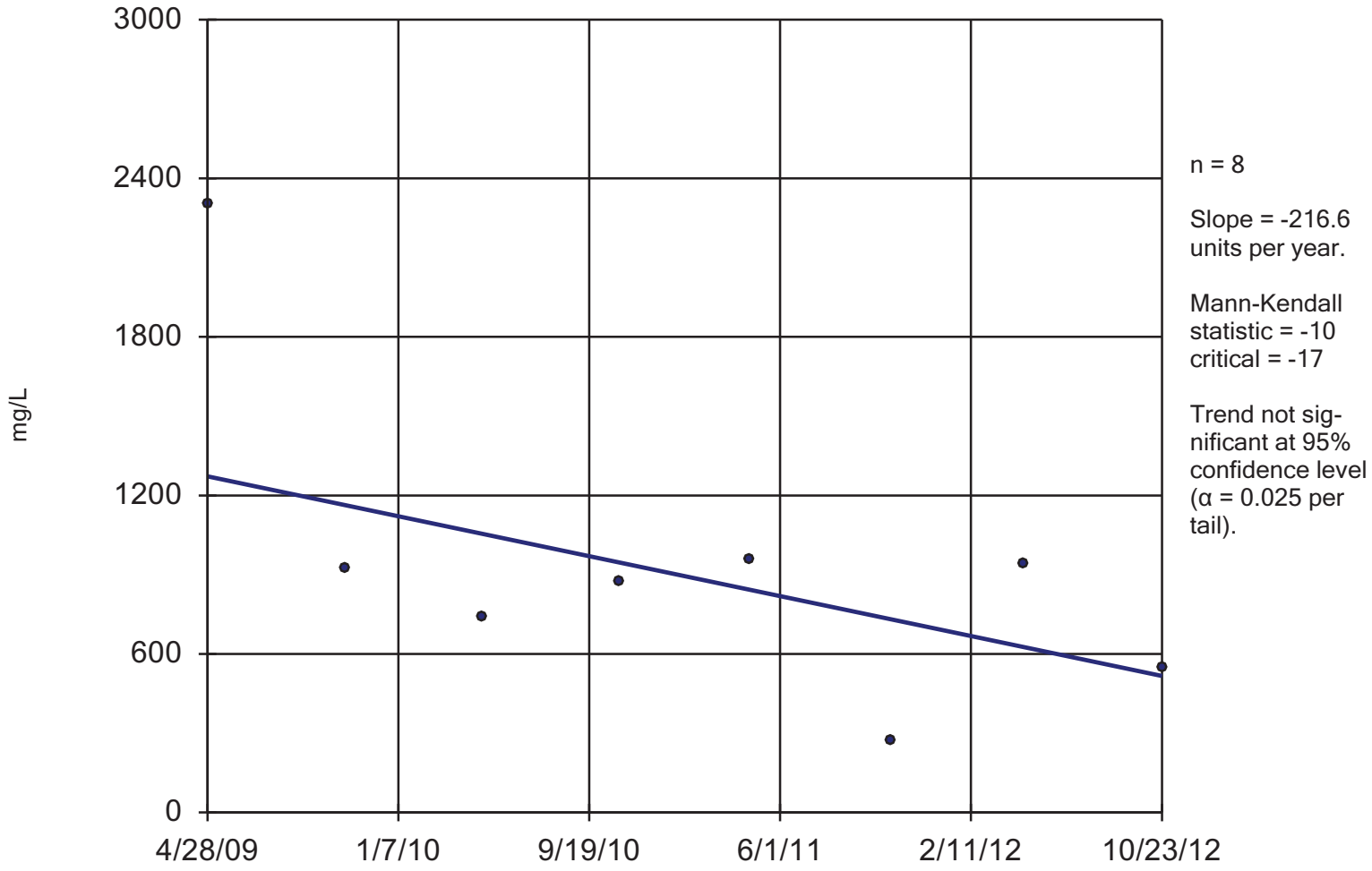



Constituent: Sulfate, total  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-6

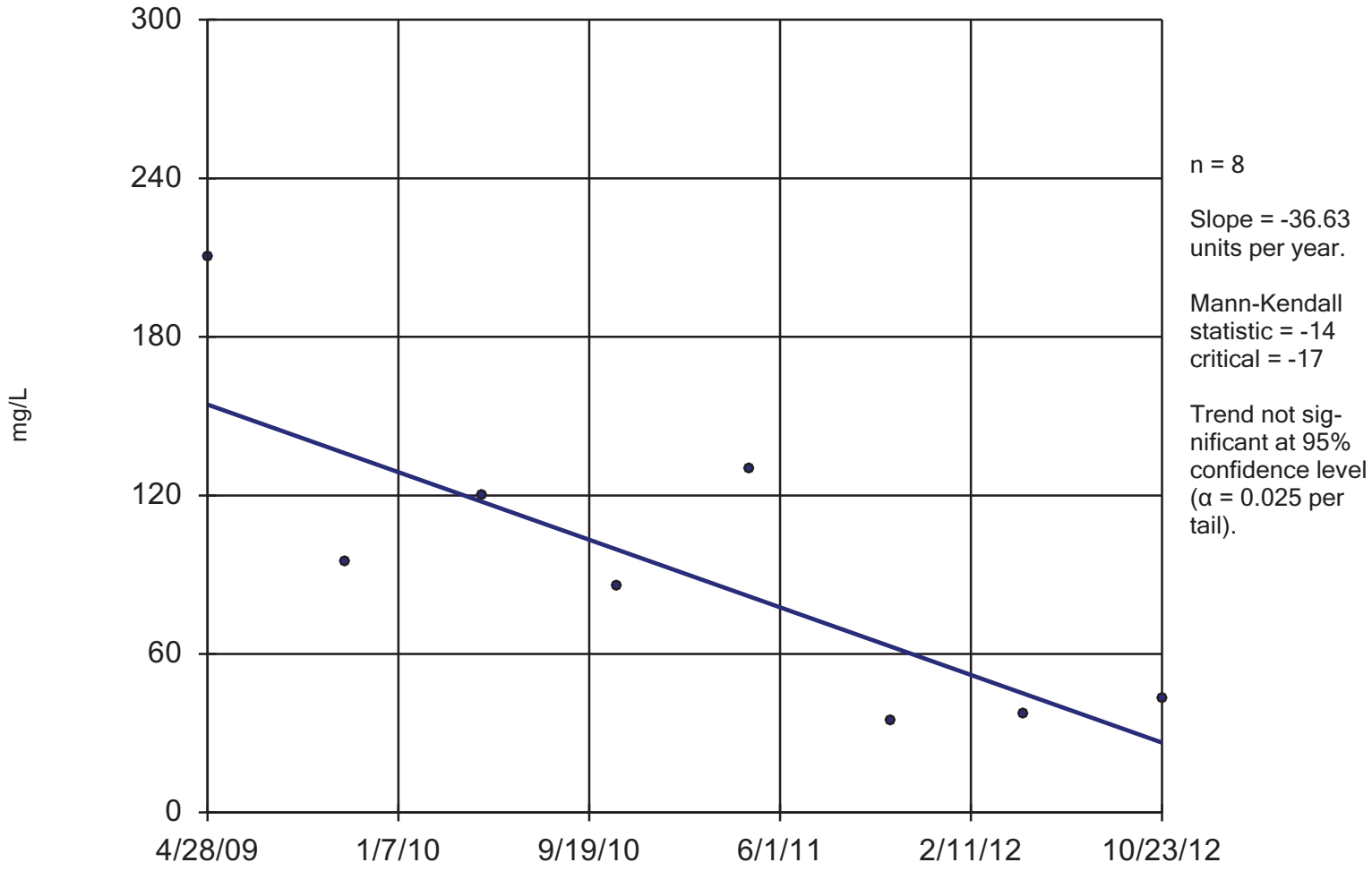



Constituent: Sulfate, total  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

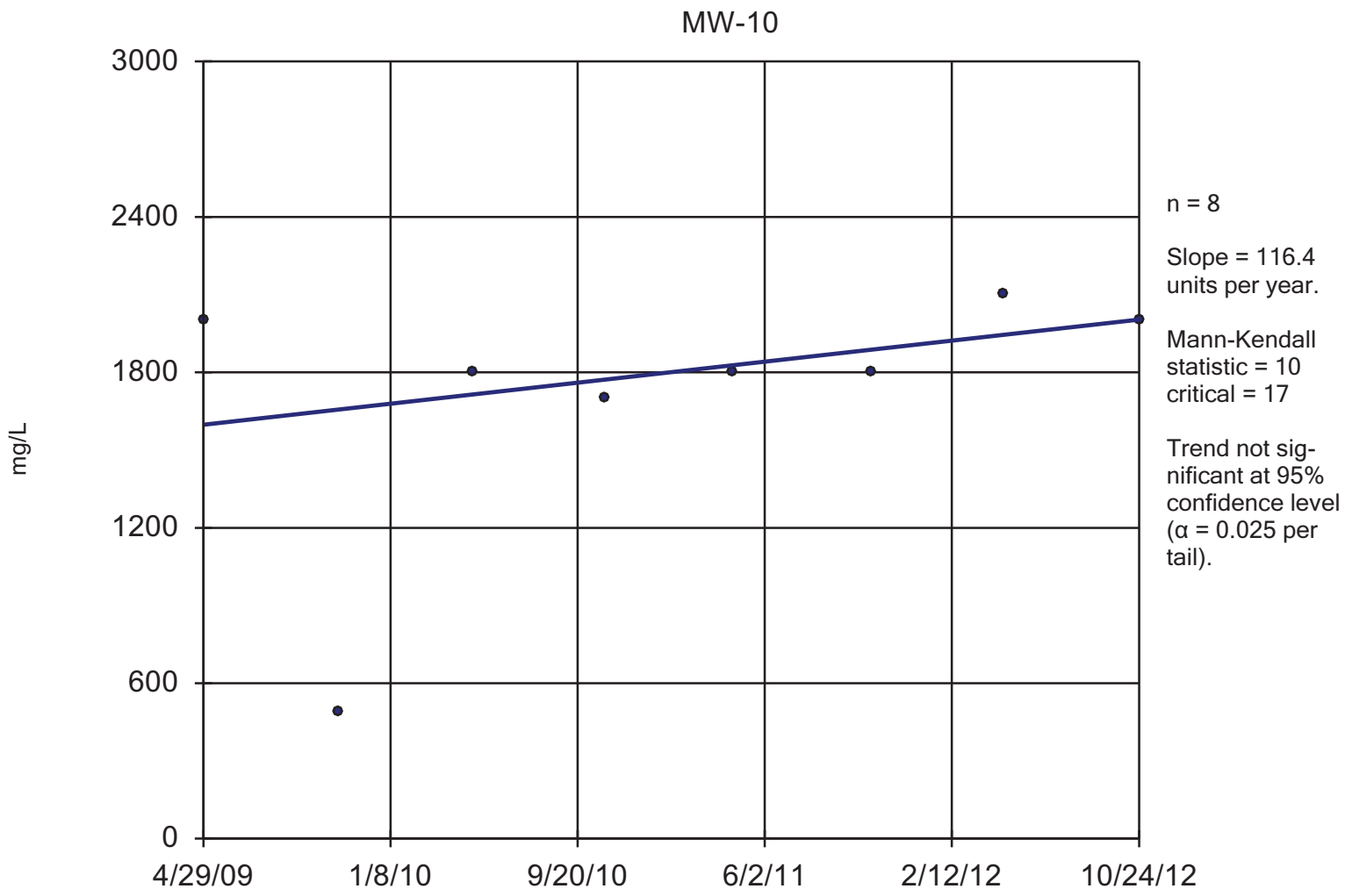
## MW-7




Constituent: Sulfate, total  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

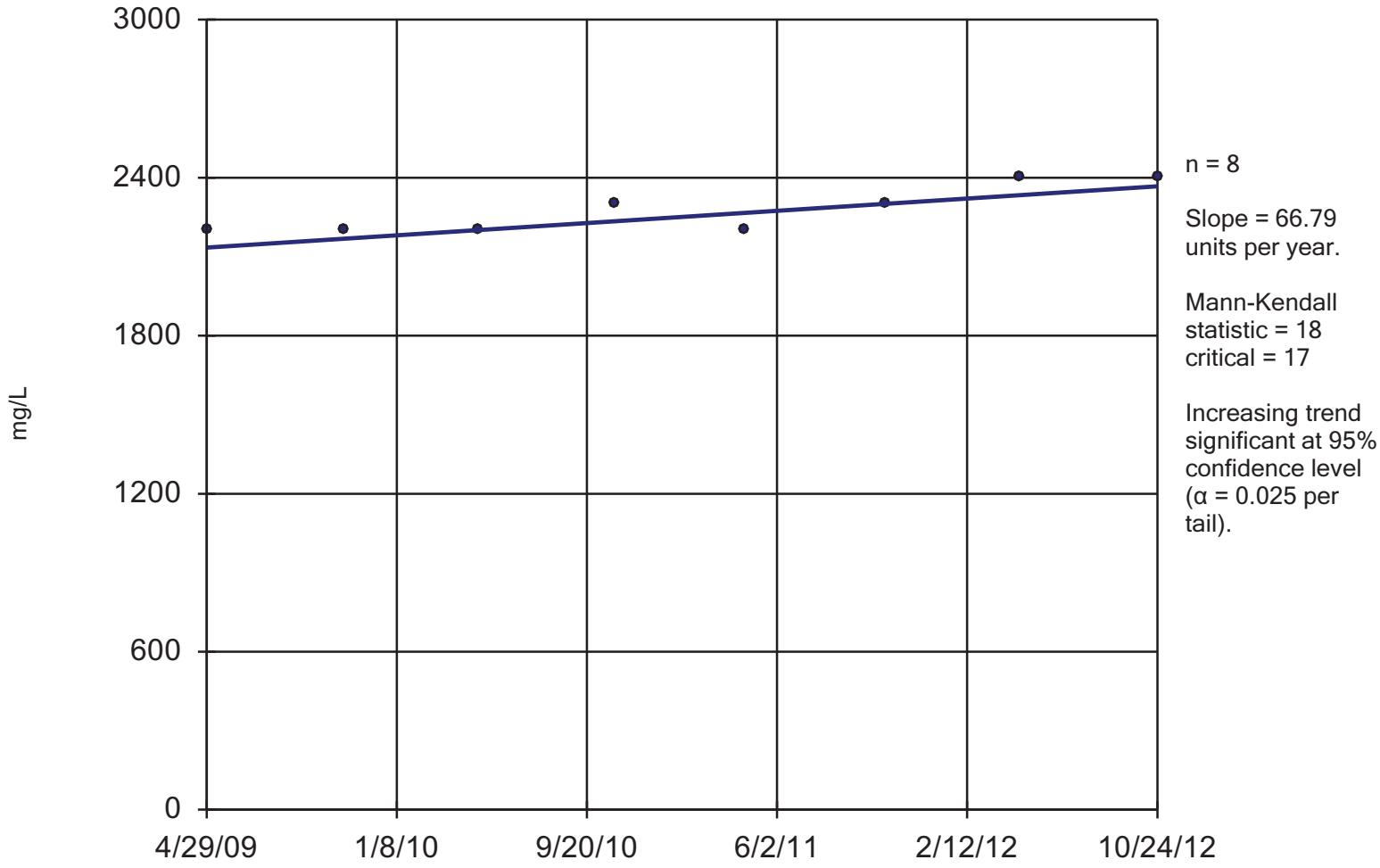



Constituent: Total Dissolved Solids Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site Client: Weaver Boos Consultants Data File: Yard520 database

# Sen's Slope Estimator

## MW-11

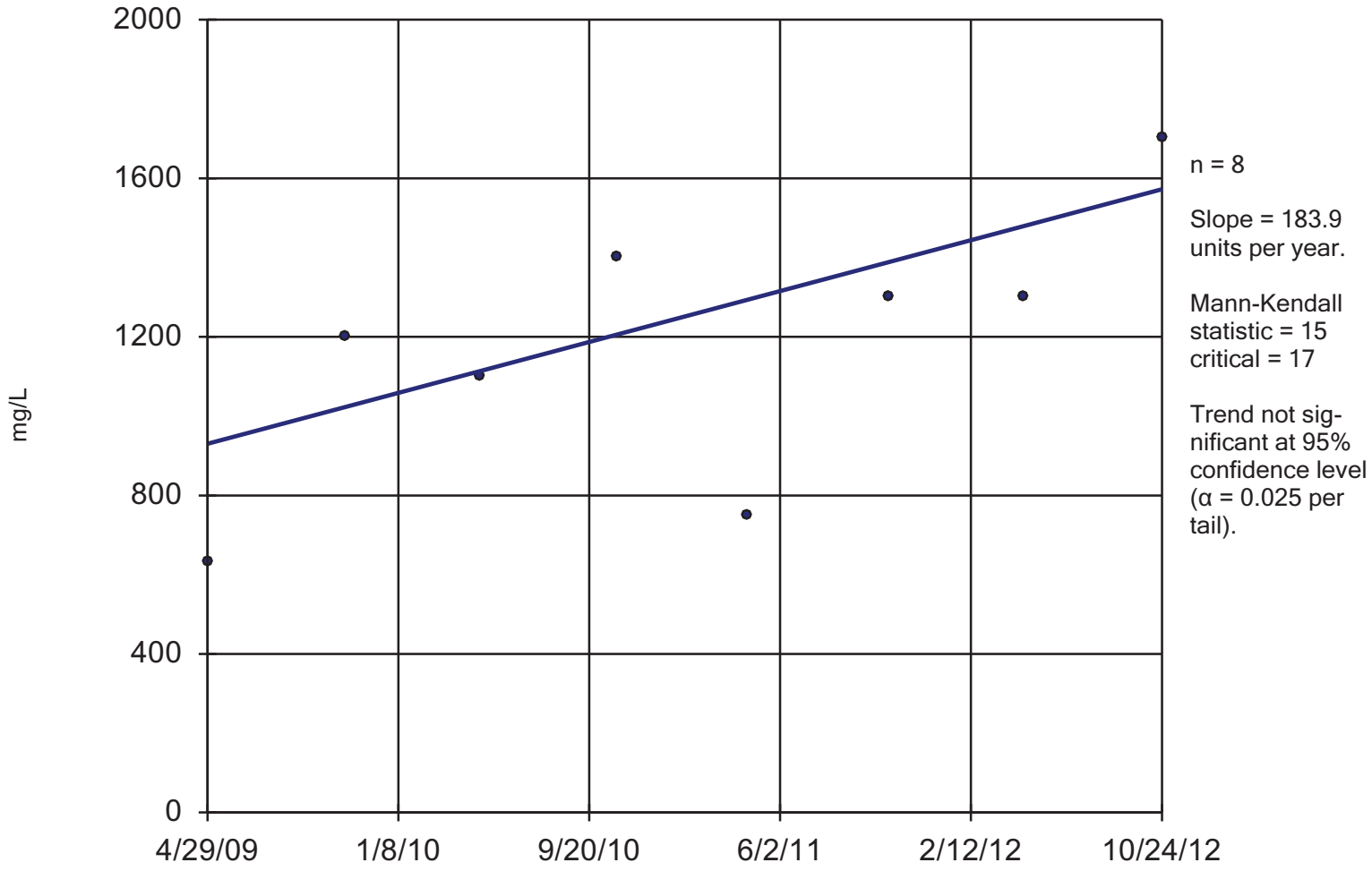



Constituent: Total Dissolved Solids Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site Client: Weaver Boos Consultants Data File: Yard520 database

# Sen's Slope Estimator

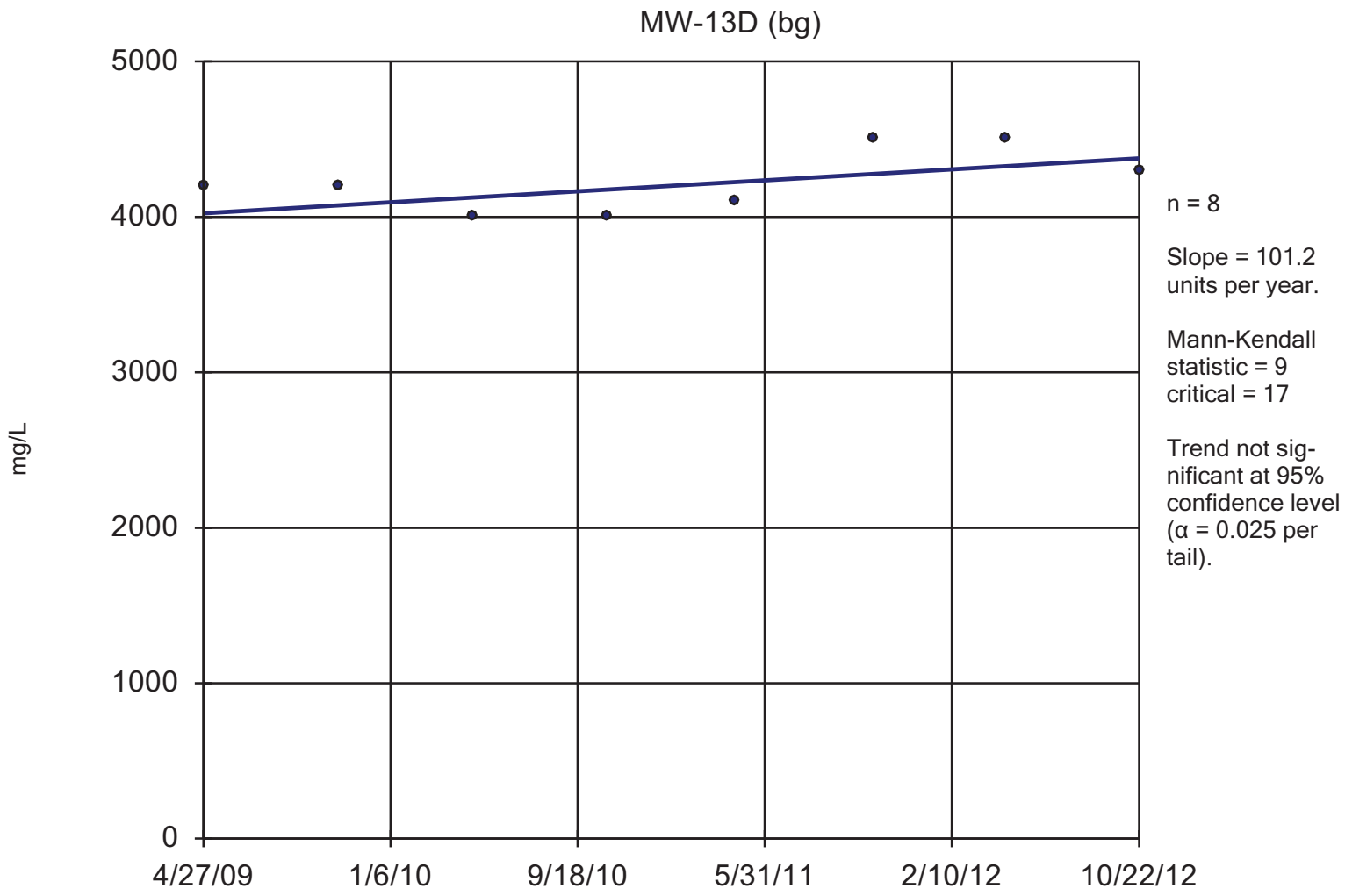
## MW-8




Constituent: Total Dissolved Solids Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site Client: Weaver Boos Consultants Data File: Yard520 database

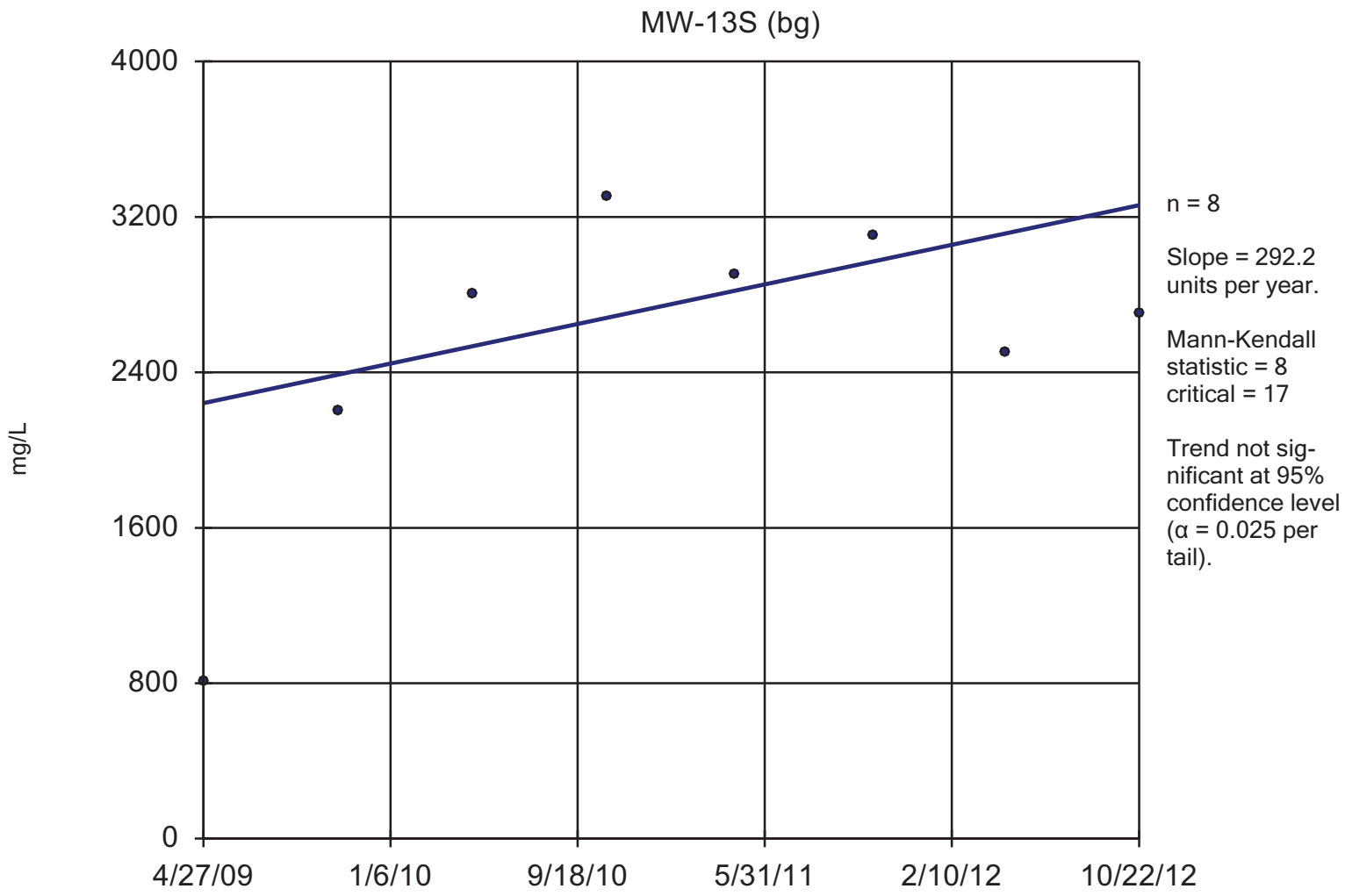
# Sen's Slope Estimator




Constituent: Total Dissolved Solids Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site Client: Weaver Boos Consultants Data File: Yard520 database

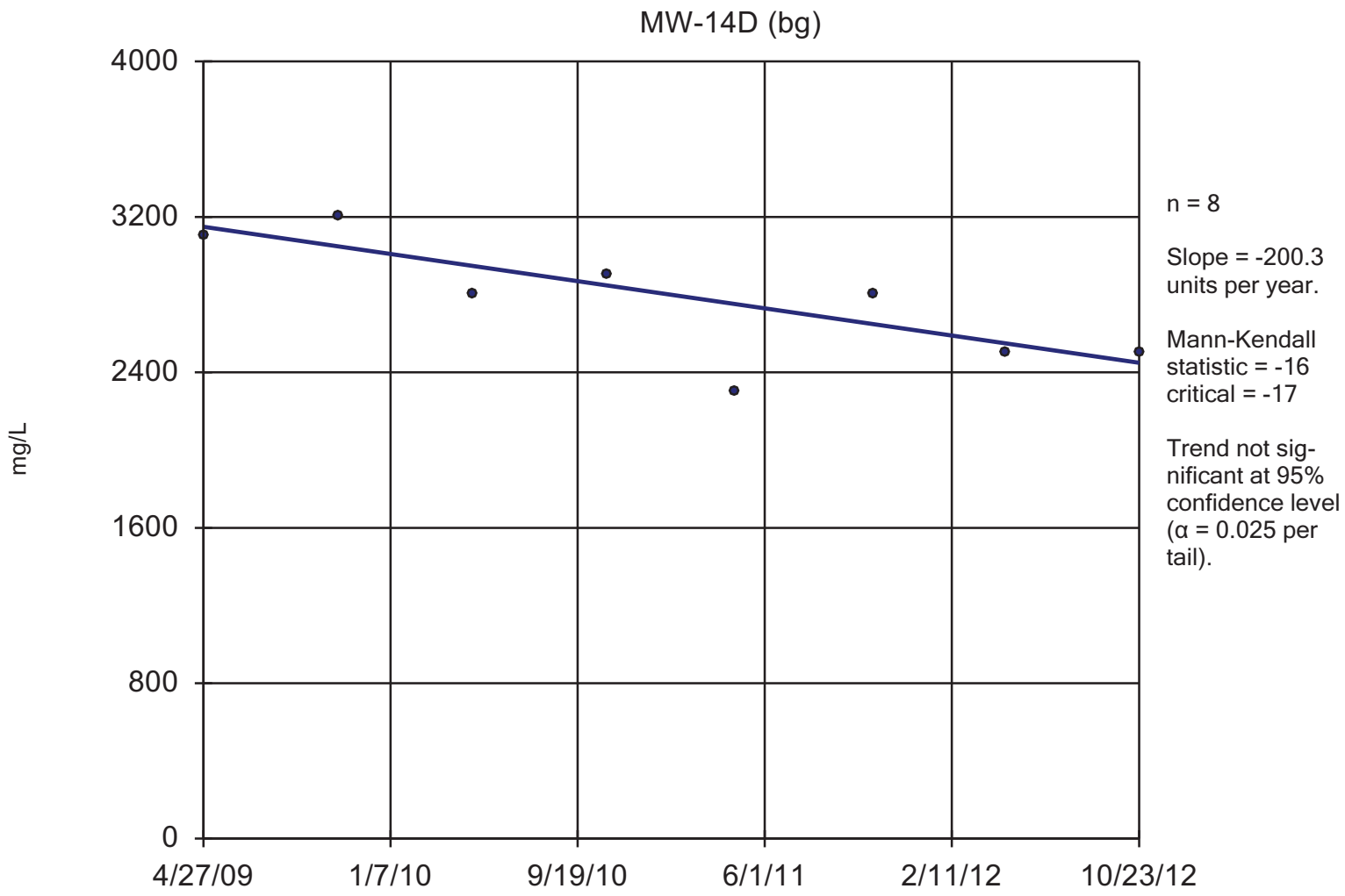
# Sen's Slope Estimator




Constituent: Total Dissolved Solids Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site Client: Weaver Boos Consultants Data File: Yard520 database

# Sen's Slope Estimator

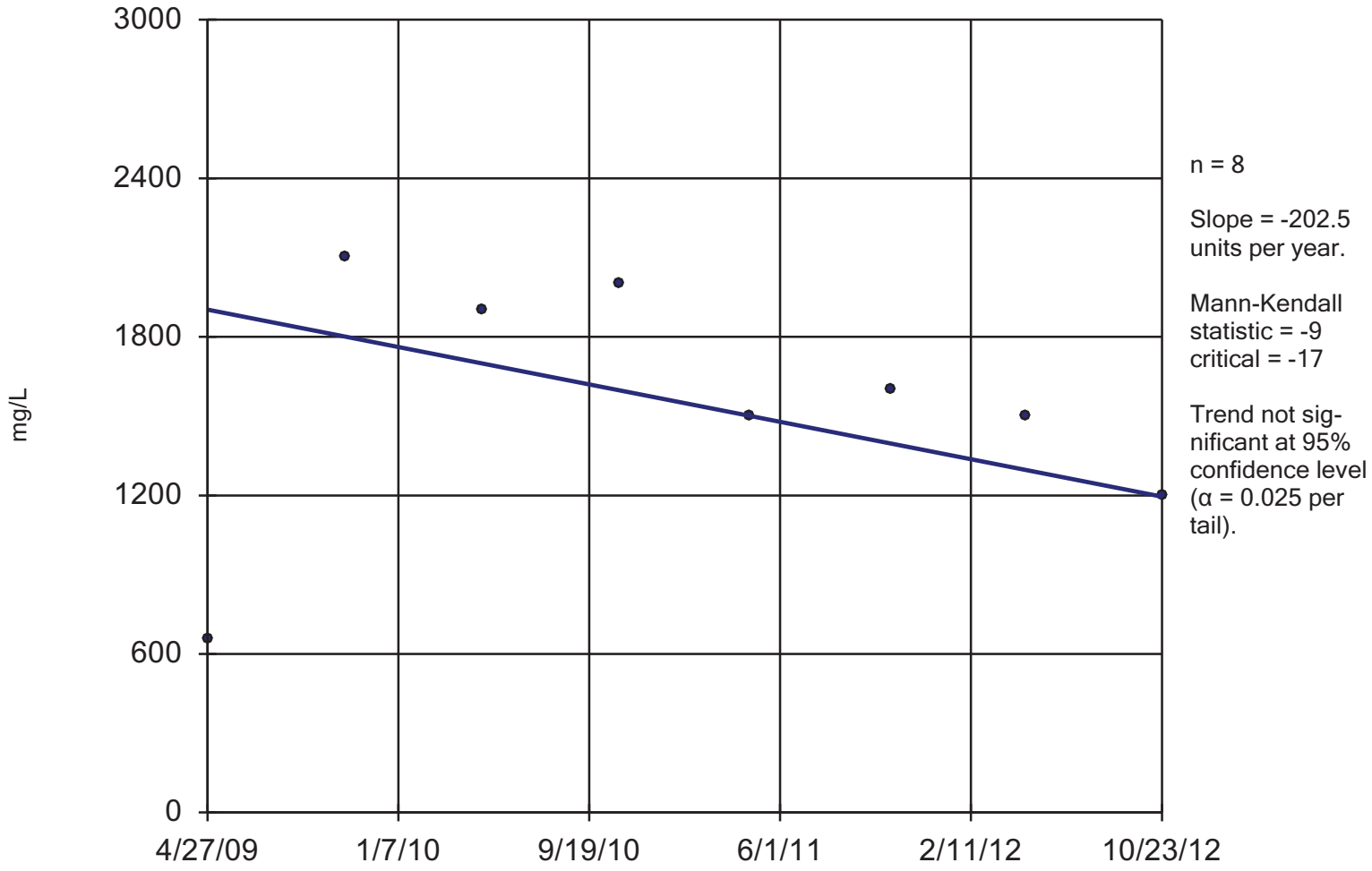



Constituent: Total Dissolved Solids  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-14S (bg)

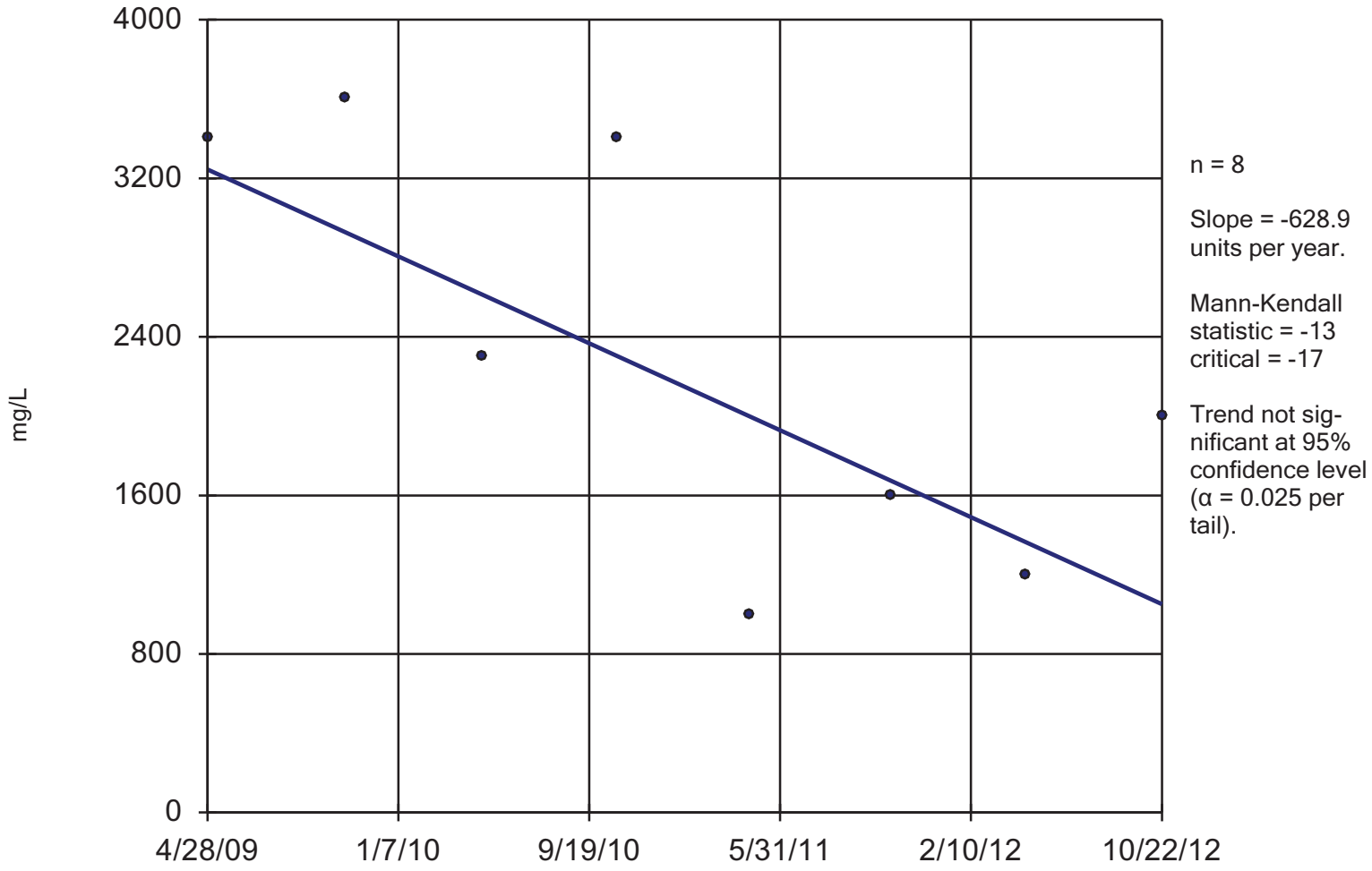



Constituent: Total Dissolved Solids  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-1R (bg)

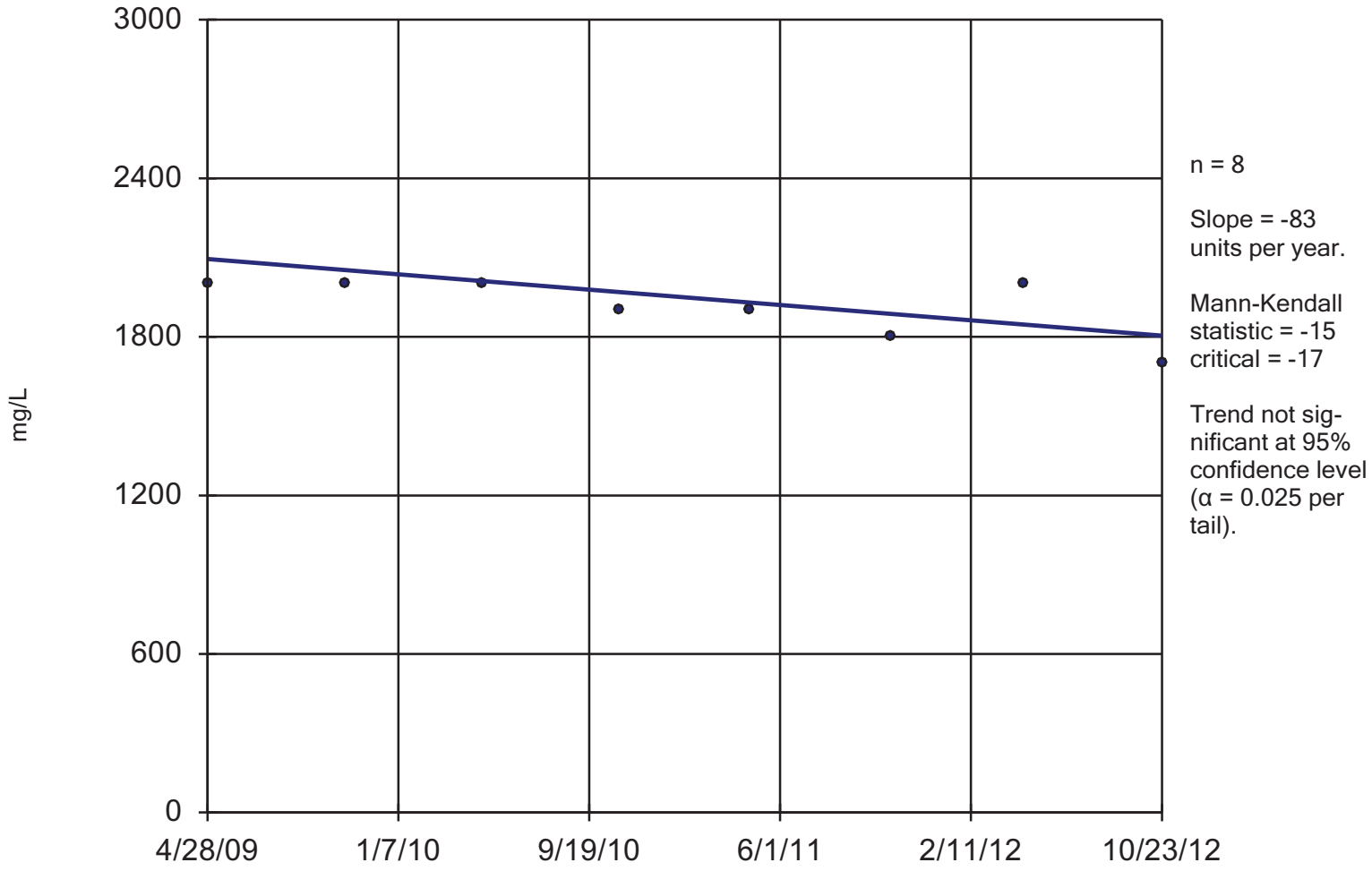



Constituent: Total Dissolved Solids  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-6

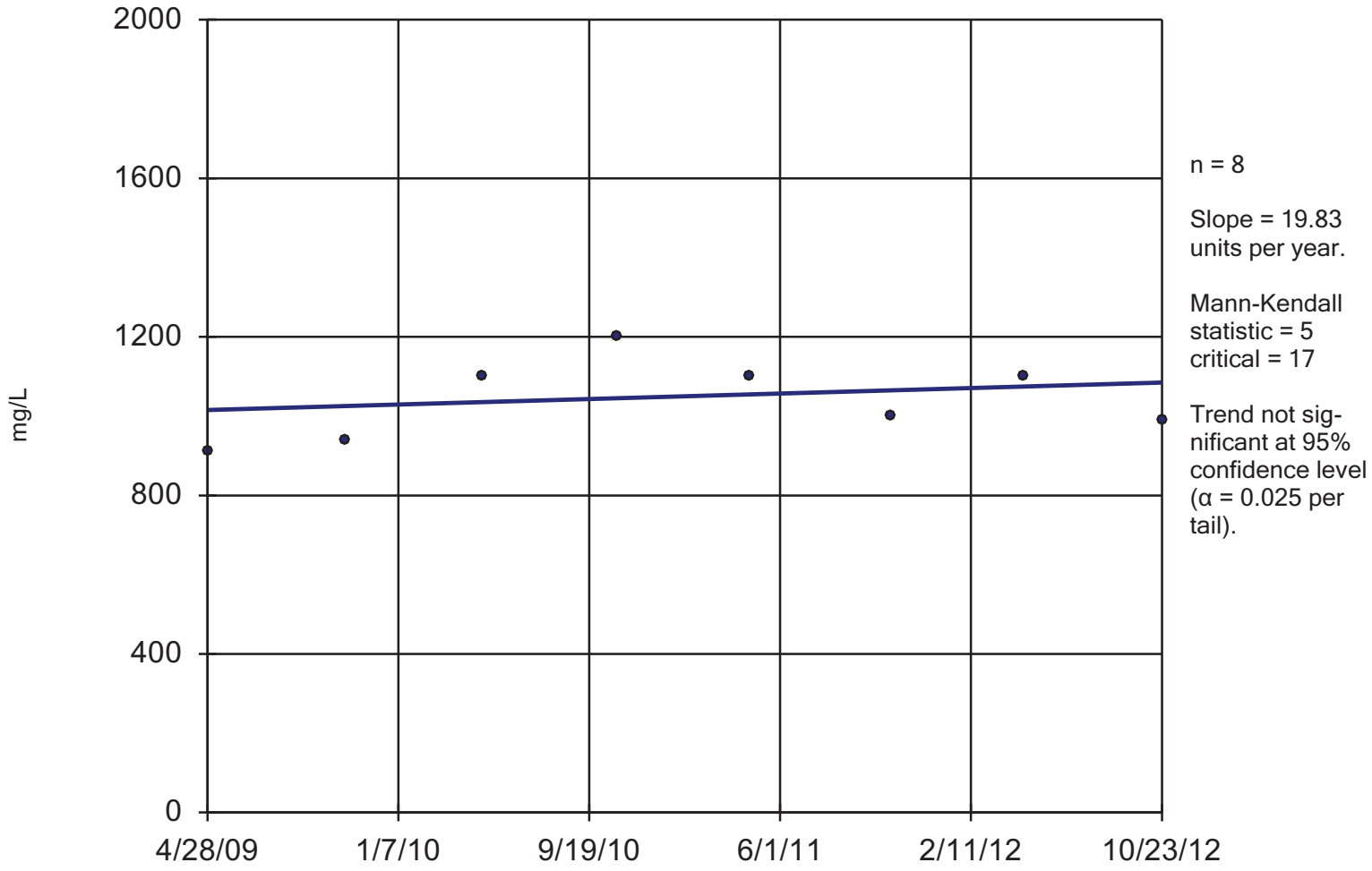



Constituent: Total Dissolved Solids  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database

# Sen's Slope Estimator

## MW-7




Constituent: Total Dissolved Solids  Analysis Run 12/14/2012 9:27 AM

Facility: Yard 520 Restricted Waste Site  Client: Weaver Boos Consultants  Data File: Yard520 database